BIG CONSTANCE LAKE AND MERMENTAU COASTAL BAYS AND GULF WATERS TMDLS FOR DISSOLVED OXYGEN AND NUTRIENTS

April 19, 2002

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SUBSEGMENTS 050802 AND 050901

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EXECUTIVE SUMMARY

Section 303(d) of the Federal Clean Water Act requires states to identify waterbodies that are not meeting water quality standards and to develop total maximum daily pollutant loads for those waterbodies. A total maximum daily load (TMDL) is the amount of pollutant that a waterbody can assimilate without exceeding the established water quality standard for that pollutant. Through a TMDL, pollutant loads can be distributed or allocated to point sources and nonpoint sources (NPS) discharging to the waterbody. This report presents TMDLs that have been developed for dissolved oxygen (DO) and nutrients for 2 subsegments in the lower Mermentau basin in southern Louisiana.

The 2 subsegments for which TMDLs were developed are:

050802 – Big Constance Lake and Associated Waterbodies
050901 – Mermentau River Basin Coastal Bays and Gulf Waters to State 3 Mile Limit

Subsegment 050802 is adjacent to the Gulf of Mexico and consists mostly of saline marsh and open water. Subsegment 050901 consists of the Gulf of Mexico from the shoreline out to the state 3 mile limit. These waterbodies receive drainage from the Mermentau River basin, which is over 3000 square miles in size and is heavily agricultural. Subsegment 050901 also receives inflow from the Louisiana coastal current. There are relatively few point source discharges in these subsegments.

Both subsegments were listed on the Modified Court Ordered 303(d) List for Louisiana as not fully supporting the designated use of propagation of fish and wildlife and were ranked as priority #1 for TMDL development. Neither of these 2 subsegments was included on the 1998 303(d) List for DO or nutrients, but both were later added to the list based on LDEQ assessment data collected during June – December 1998. The causes for impairment cited in the 303(d) List included organic enrichment/low DO for both subsegments and nutrients for subsegment 050901. The water quality standard for DO is 4 mg/L year round for subsegment 050802 and 5 mg/L year round for 050901.

A water quality model (LA-QUAL) was set up to simulate DO, CBOD, ammonia nitrogen, and organic nitrogen in these subsegments. The model was calibrated using LDEQ assessment data collected during June – December 1998 and other various information obtained from LDEQ and other sources. There were no intensive survey data available for these subsegments. The projection simulation was run at critical flows and temperatures to address seasonality as required by the Clean Water Act. Reductions of existing NPS loads were required for the projection simulation to show the DO standards being maintained. In general, the modeling in this study was consistent with guidance in the Louisiana TMDL Technical Procedures Manual.

TMDLs for oxygen demanding substances (CBOD, ammonia nitrogen, organic nitrogen, and sediment oxygen demand) were calculated using the results of the projection simulation. Both implicit and explicit margins of safety were included in the TMDL calculations. The nutrient TMDLs were developed based on Louisiana's water quality standard for nutrients, which states that "the naturally occurring range of nitrogen to phosphorus ratios shall be maintained". The nutrient TMDLs were calculated using allowable nitrogen loadings from the projection simulation and applying a naturally occurring nitrogen to phosphorus ratio to determine the allowable phosphorus loadings.

The TMDLs for each subsegment include a WLA for the point sources with minor oxygen demanding discharges. There are no major point sources in either subsegment. NPS reductions of 48% to 97% are required for the waterbodies in these subsegments to meet the water quality standards for DO.

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1.0 INTRODUCTION

This report presents total maximum daily loads (TMDLs) for dissolved oxygen (DO) and nutrients for the 2 subsegments listed in Table 1.1. Each of these 2 subsegments was listed on the February 29, 2000 Modified Court Ordered 303(d) List for Louisiana (EPA 2000) as not fully supporting the designated use of propagation of fish and wildlife. Neither of these subsegments was included on the 1998 303(d) List (LDEQ 1998) for DO or nutrients, but both subsegments were later added to the list for organic enrichment/low DO based on LDEQ assessment data collected during June – December 1998. The suspected sources and suspected causes for impairment in the 303(d) List are included in Table 1.1. Both subsegments were ranked as priority #1 for TMDL development. The TMDLs in this report were developed in accordance with Section 303(d) of the Federal Clean Water Act and EPA's regulations at 40 CFR 130.7. The 303(d) Listings for other pollutants in these subsegments are being addressed by EPA and the Louisiana Department of Environmental Quality (LDEQ) in other documents.

The purpose of a TMDL is to determine the pollutant loading that a waterbody can assimilate without exceeding the water quality standard for that pollutant and to establish the load reduction that is necessary to meet the standard in a waterbody. The TMDL is the sum of the wasteload allocation (WLA), the load allocation (LA), and a margin of safety (MOS). The WLA is the load allocated to point sources of the pollutant of concern, and the LA is the load that is allocated to nonpoint sources (NPS). The MOS is a percentage of the TMDL that accounts for the uncertainty associated with the model assumptions, data inadequacies, and future growth.

Table 1.1. Summary of 303(d) Listing of the 2 subsegments in the study area (EPA 2000).

Subsegment Number	Waterbody Description	Suspected Sources	Suspected Causes	Priority Ranking (1 = highest)
050802	Big Constance Lake and Associated Waterbodies	None stated	Organic enrichment/low DO	1
050901	Mermentau River Basin Coastal Bays and Gulf Waters to the State three-mile limit	Agriculture Petroleum activities Industrial Municipal Non-irrigated crop production Irrigated crop production	Organic enrichment/low DO Nutrients Oil & grease Suspended solids Turbidity Pesticides Siltation Mercury	1

2.0 STUDY AREA DESCRIPTION

2.1 General Information

Both subsegments in the study area are part of the lower portion of the Mermentau River basin in southern Louisiana (see map in Appendix A). The Big Constance Lake subsegment is adjacent to the Gulf of Mexico and consists mostly of saline marsh and open water (Table 2.1). This subsegment is mostly cut off from Grand Lake and White Lake due to the Grand Chenier Ridge (Highway 82 follows this ridge). Most of the inflow to Grand Lake and White Lake reaches the Gulf of Mexico through other waterbodies (Gulf Intracoastal Waterway, Schooner Bayou Canal, and Mermentau River). However, some water from Grand Lake does enter the Big Constance Lake subsegment through Superior Canal and other small canals. When water levels in the Gulf of Mexico are higher than water levels in Grand Lake and White Lake (which occurs frequently in the summer and early fall), the flow in those canals is in the northward direction. A number of small control structures have been built in the Rockefeller Wildlife Refuge to prevent flooding from high flows from the Superior Canal and to prevent saltwater intrusion into the Grand Lake / White Lake system. Generally, these control structures are open in the late fall to early spring and closed from April to October (Coastal Environments, Inc. 1983). The Rockefeller Wildlife Refuge covers approximately the entire western half of the Big Constance Lake subsegment.

Subsegment 050901 (Mermentau River Basin Coastal Bays and Gulf Waters) consists of the Gulf of Mexico from the shoreline to the state 3 mile limit. It is bounded on the west by the Calcasieu Basin coastal waters and on the east by the Vermilion-Teche Basin coastal waters. This subsegment receives drainage from the Mermentau River as well as local runoff from the Big Constance Lake subsegment and adjacent areas. As noted above, water levels in the Gulf of Mexico are frequently higher than water levels in Grand Lake and White Lake during the summer and early fall. During these conditions, subsegment 050901 does not receive any freshwater inflow from the Mermentau basin.

Table 2.1. Land uses in the study area based on GAP data (USGS 1998).

Land Use Type	% of Total Area	
	050802	050901
Fresh Marsh	6.6	0.0
Saline Marsh	58.5	0.0
Wetland Forest	0.0	0.0
Upland Forest	0.1	0.0
Wetland Scrub/Shrub	0.2	0.0
Upland Scrub/Shrub	1.1	0.0
Agricultural	0.0	0.0
Urban	0.0	0.0
Barren	0.5	0.0
Water	33.0	100.0
TOTAL	100.0	100.0

Another inflow to subsegment 050901 is the westward flow of water in the Gulf of Mexico from near the mouths of the Atchafalaya and Mississippi Rivers. This movement of water, which is known as the Louisiana Coastal Current, allows some fresh water and its associated sediment and nutrients to flow towards subsegment 050901.

2.2 Water Quality Standards

The numeric water quality standards and designated uses for these subsegments are shown in Table 2.2. The primary numeric standards for the TMDLs presented in this report are the DO standards of 4 mg/L year round for subsegment 050802 and 5 mg/L year round for subsegment 050901.

For nutrients, there are no specific numeric criteria, but there is a narrative standard that states “The naturally occurring range of nitrogen-phosphorus ratios shall be maintained.... Nutrient concentrations that produce aquatic growth to the extent that it creates a public nuisance or interferes with designated water uses shall not be added to any surface waters.” (LDEQ 2000a).

Table 2.2. Water quality standards and designated uses (LDEQ 2000a).

Subsegment	050802	050901
Waterbody Description	Big Constance Lake and Associated Waterbodies	Mermentau River Basin Coastal Bays and Gulf Waters to the State three-mile limit
Designated Uses	ABC	ABCE
Criteria:		
Chloride	N/A	N/A
Sulfate	N/A	N/A
DO	4 mg/L (year round)	5 mg/L (year round)
pH	6.5 – 9.0	6.5 – 9.0
Temperature	35 °C	32 °C
TDS	N/A	N/A

USES: A – primary contact recreation; B – secondary contact recreation; C – propagation of fish and wildlife; D – drinking water supply; E – oyster propagation; F – agriculture; G – outstanding natural resource water; L – limited aquatic life and wildlife use.

In addition, LDEQ issued a declaratory ruling on April 29, 1996, concerning this language and stated, “That DO directly correlates with overall nutrient impact is a well-established biological and ecological principle. Thus, when the LDEQ maintains and protects DO, the LDEQ is in effect also limiting and controlling nutrient concentrations and impacts.” DO serves as the indicator for the water quality criteria and for assessment of use support. For the TMDLs in this report, the nutrient loading required to maintain the DO standard is the nutrient TMDL.

2.3 Identification of Sources

2.3.1 Point Sources

Lists of NPDES permits that were identified in or near each subsegment in the study area are included in Appendix B. These permits were identified by searching two sources of information. The primary source was a listing of all the permits in the Mermentau basin (basin number 05) from the LDEQ static database. The secondary source was a listing of all the permits in the Mermentau basin (hydrologic units 08080201 and 08080202) from EPA’s Permit Compliance System (PCS) on the EPA website. All of the information concerning permit parameters and design flow in Appendix B was obtained by manually retrieving hard copies of permit files from LDEQ's file room.

Facilities without oxygen demanding parameters in their permit were assumed to exert a negligible oxygen demand in the receiving stream; therefore, these facilities were excluded from any further consideration in these TMDLs. All of the facilities with oxygen demanding parameters in their permit were included in the TMDL calculations, but none were considered large enough to be modeled explicitly. The oxygen demanding discharges were included in the TMDL by adding their oxygen demand to the load simulated in the model.

2.3.2 Nonpoint Sources

Several NPS were cited as suspected sources of impairment in the 303(d) List (Table 1.1). These NPS include agriculture, petroleum activities, industrial sources, municipal sources, non-irrigated crop production, and irrigated crop production.

2.4 Previous Data and Studies

Listed below are previous water quality data and studies in or near the subsegments in the study area. Locations of the LDEQ ambient monitoring stations are shown in Appendix A.

1. Twice monthly data collected by LDEQ for "Big Constance Lake" (station 0661) for mid-June to December 1998. This station is located on Highway 82 at Superior Canal. Although LDEQ named this station "Big Constance Lake", the station is actually located outside the subsegment.
2. Twice monthly data collected by LDEQ for "Mermentau Coastal Bays and Gulf Waters" (station 0662) for mid-June to December 1998. This station is near Joseph Harbor Bayou.
3. An Evaluation of Wetland Management Techniques for the Rockefeller State Wildlife Refuge and Game Preserve (Coastal Environments, Inc. 1983).

Also, there have been numerous studies by various organizations and agencies concerning hypoxia in the Gulf of Mexico. Nearly all of the data collected in these studies has been from locations outside subsegment 050901 (i.e., farther offshore).

3.0 CALIBRATION OF WATER QUALITY MODEL

3.1 Model Setup

In order to evaluate the linkage between pollutant sources and water quality, a computer simulation model was used. The model used for these TMDLs was LA-QUAL (version 3.02), which was selected because it includes the relevant physical, chemical, and biological processes and it has been used successfully in the past for other TMDLs in Louisiana. The LA-QUAL model was set up to simulate organic nitrogen, ammonia nitrogen, ultimate carbonaceous biochemical oxygen demand (CBODu), and DO. Phosphorus and algae were not simulated because algae do not appear to have significant impacts on DO in these subsegments.

A vector diagram of the model is shown in Appendix C. The vector diagram shows the reach/element design. The model was divided into 3 reaches with each reach consisting of only one element. The first reach represented the Big Constance Lake subsegment (050802), while the third represented the Gulf Waters subsegment (050901). The second reach was a small "connector" reach that was added to prevent excessive dispersive exchange between reaches 1 and 3. The number of separate reaches and elements was minimized due to the small amount of available data.

Superior Canal was designated as the headwater inflow for the model. The Louisiana coastal current was specified as a tributary to the Gulf Waters subsegment. Although the Mermentau River is a major inflow to the Gulf Waters subsegment (050901) during parts of the year, it was not included in the model as a tributary because it had negligible flow in the downstream direction both during the calibration period and for critical conditions.

3.2 Calibration Period

An intensive field survey was not performed for the study area due to schedule and budget limitations. A synoptic survey of the study area was performed by FTN in September 2000, but only limited data were collected during that survey. Therefore, the model was calibrated to historical conditions. The only historical period for which water quality data were collected for both subsegments was the June through December 1998 period when LDEQ collected their assessment data. The LDEQ stations for the subsegments in the study area are:

Station 0661 – Big Constance Lake (subsegment 050802)
Station 0662 – Mermentau Coastal Bays and Gulf Waters (subsegment 050901)

The water quality data for this period were retrieved from the LDEQ website. These data are listed in tabular form in Appendix D and the temperature and DO are plotted in Appendix D. The two conditions that usually characterize critical periods for DO are high temperatures and low flows. High temperatures decrease DO saturation values and increase rates for oxygen demanding processes (BOD decay, nitrification, and sediment oxygen demand (SOD)). In most systems, low flows cause reaeration rates to be lower. The purpose of selecting a critical period for calibration is so that the model will be calibrated as accurately as possible for making projection simulations for critical conditions.

Based on the data in Appendix D, the calibration period was selected as September 1 to October 6, 1998 (Julian day 244 to 279). This period represented the most critical period for DO.

The calibration targets (i.e., the concentrations to which the model was calibrated) for each parameter for each LDEQ station were set to the average of the concentrations measured during the calibration period.

3.3 Temperature Correction of Kinetics (Data Type 4)

The temperature correction factors used in the model were consistent with the Louisiana Technical Procedures Manual (the "LTP"; LDEQ 2000b). These correction factors were:

- Correction for BOD decay: 1.047 (value in LTP is same as model default)
- Correction for SOD: 1.065 (value in LTP is same as model default)
- Correction for ammonia N decay: 1.070 (specified in Data Group 4)
- Correction for organic N decay: 1.020 (not specified in LTP; model default used)
- Correction for reaeration: calculated automatically by the model

3.4 Hydraulics and Dispersion (Data Types 9 and 10)

The hydraulics were specified in the input for the LA-QUAL model using the power functions (width = a * Q^b + c and depth = d * Q^e + f). Under low flow conditions, the water levels throughout the subsegments being modeled can be assumed to be independent of flow rate. Therefore, the system was modeled with constant depth and width. This was specified in the model by setting the coefficients and exponents as follows (values for each reach are shown in Appendix E):

- width coefficient (a) = 0.0
- width exponent (b) = 0.0
- width constant (c) = width
- depth coefficient (d) = 0.0
- depth exponent (e) = 0.0
- depth constant (f) = depth

Widths and depths were estimated primarily from topographic maps and information from the staff at Rockefeller Wildlife Refuge (see Appendix E).

Tidal dispersion was accounted for by specifying dispersion coefficients in data group 10 of the model input. The dispersion coefficient for reach 3 was set to 50 m^2/sec, which is the same value used in the model for West Cote Blanche Bay (FTN 2001a). This value is also consistent with data reported in literature for estuarine systems (EPA 1985). For reaches 1 and 2, the dispersion was assumed to be significantly less than for reach 3 (due to the vegetation and land masses interspersed throughout reaches 1 and 2 as well as shallower depths in reaches 1 and 2).

3.5 Initial Conditions (Data Type 11)

The primary parameter that is specified in the initial conditions for LA-QUAL is the temperature for each reach (because temperature was not being simulated). The temperature for each reach was set to the average of the measured values at the appropriate LDEQ station during the calibration period. The input data and sources are shown in Appendix E.

For constituents not being simulated, the initial concentrations were set to zero; otherwise, the model would have assumed a fixed concentration of those constituents and the model would have included the effects of the unmodeled constituents on the modeled constituents (e.g., the effects of algae on DO).

3.6 Water Quality Kinetics (Data Types 12 and 13)

Kinetic rates used in LA-QUAL include reaeration rates, SOD, CBOD decay rates, nitrification rates, and mineralization rates (organic nitrogen decay). The values used in the model input are shown in Appendix E.

For reaeration, the surface transfer coefficient (K_L) was specified for each reach (option 20 in the model). Under low flow conditions, all of the reaches in this model have velocities so low that reaeration equations such as the Texas equation or the O'Connor-Dobbins equation would yield reaeration coefficients that are lower than the minimum values specified in the LTP (0.7 m/day divided by depth). Also, both subsegments were considered to have little wind sheltering so that wind-aided reaeration would be significant. Therefore, a wind-aided surface transfer coefficient was calculated using the same methodology as used in the Mermentau River model (LDEQ 1999). Daily wind speeds from Lake Charles were averaged over the calibration period, corrected to a height of 0.1 m, and then used to calculate a wind-aided surface transfer coefficient of 1.15 m/day.

The CBOD decay rate was set to the default value of 0.10/day that LDEQ provided in its guidance for uncalibrated modeling of the Mermentau and Vermilion-Teche basins (LDEQ 2000c). The SOD rates were developed through iteration in the calibration. The SOD rate for each reach was adjusted so that predicted DO concentrations were similar to the calibration target values.

The mineralization rate (organic nitrogen decay) in the model was set to 0.02/day for both reaches. This value was based on information in "Rates, Constants, and Kinetics Formulations in Surface Water Quality Modeling" (EPA 1985). The nitrification rate was set to 0.10/day for both reaches, which is consistent with guidance in the LTP based on stream depth. The combination of these rates is consistent with LDEQ's guidance for uncalibrated modeling of the Mermentau and Vermilion-Teche basins (LDEQ 2000c). The LDEQ guidance specified a default rate of 0.05/day for nitrogenous biochemical oxygen demand (NBOD) decay, which represents the combination of mineralization and nitrification.

One other input value was specified for characterizing the nitrification process. In the program constants section of the model input file (data type 3), the nitrification inhibition option was set to 1 instead of the default of option number 2. With the default option, the nitrification rate decreases rapidly when the DO drops below 2 mg/L, which results in an unrealistic build up of ammonia nitrogen at low DO values. Option number 1 provides nitrification inhibition that is similar to what is used in other water quality models such as QUAL2E and WASP (see Figure 3.5 in FTN 2000a).

3.7 Nonpoint Source Loads (Data Type 19)

The NPS loads that are specified in the model can be most easily understood as resuspended load from the bottom sediments and are modeled as SOD, benthic ammonia source rates, CBOD loads, and organic nitrogen loads. The SOD (specified in data type 12), the benthic ammonia source rates (specified in data type 13), and the mass loads of organic nitrogen and CBODu (specified in data type 19) were all treated as calibration parameters; their values were adjusted until the model output was similar to the calibration target values.

These four calibration parameters were adjusted in a specific order based on the interactions between state variables in the model. First, the organic nitrogen loads were adjusted until the predicted organic nitrogen concentrations were similar to the observed concentrations. Organic nitrogen was calibrated first because none of the other state variables affect the organic nitrogen concentrations. Next, the benthic ammonia source rates were adjusted until the predicted ammonia nitrogen concentrations were similar to the observed concentrations. Then the CBODu loads were adjusted until the predicted CBODu concentrations were similar to the observed concentrations. Finally, the SOD rates were adjusted until the predicted DO concentrations were similar to the observed concentrations. The DO was calibrated last because all of the other state variables affect DO.

3.8 Headwater and Tributary Flow Rates (Data Types 20 and 24)

During the calibration period for this system, the water levels in the Gulf of Mexico were higher than in the Mermentau River basin (FTN 2001b). Therefore, the flow rate for the headwater inflow through Superior Canal was set to zero. Also, there was negligible flow from the Mermentau River to the Gulf Waters subsegment (050901) during this time.

For the tributary representing the Louisiana coastal current, the flow rate was estimated as the depth of reach 3 times the length of reach 3 times an estimated velocity of 1 cm/sec (Rabalais et al 1999). The concentrations of DO, ammonia nitrogen, and nitrate+nitrite were based on data submitted to EPA during the public comment period. These data were collected at numerous stations in the Gulf of Mexico offshore from the Mermentau basin. Concentrations of CBODu and organic nitrogen were based on LDEQ ambient monitoring data at station 0697 (Southwest Pass). The values used as model input are shown in Appendix E.

3.9 Headwater and Tributary Water Quality (Data Types 21 and 25)

Because there was no inflow to the system from headwaters or tributaries, the water quality concentrations for these inflows had no effect on the model output.

3.10 Point Source Inputs (Data Types 24 and 25)

There were no oxygen demanding point source discharges that were large enough to be explicitly modeled. Therefore, the model inputs for point source discharges were set to zero.

3.11 Lower Boundary Condition (Data Type 27)

Because longitudinal dispersion was explicitly specified in data type 10, the model required input values for downstream boundary conditions. The downstream boundary concentrations for DO, ammonia nitrogen, and nitrate+nitrite were based on data submitted during the public comment period. CBODu and organic nitrogen concentrations were set to the average values during the calibration period for LDEQ station 0697 (Southwest Pass of Vermilion Bay). The values used as model input are shown in Appendix E.

The LDEQ ambient monitoring data included DO, total organic carbon (TOC), and total Kjeldahl nitrogen (TKN), but not CBOD or ammonia nitrogen. Therefore, CBODu was estimated from TOC and organic nitrogen was estimated from TKN. Relationships between these parameters were developed using data from the FTN synoptic survey in September 2000 and data from LDEQ's long term BOD analyses during 2000. The median ratio of TOC to $CBOD_5$ from the FTN synoptic survey data was 6.0 and the median ratio of CBODu to $CBOD_5$ from the LDEQ long term BOD data was 4.5. Combining these ratios yielded the following relationship that was used to develop model inputs:

CBODu = 0.75 * TOC

Also, the median ratio of ammonia nitrogen to TKN from the FTN synoptic survey data was 0.17. This value was similar to the median ratio of ammonia nitrogen to TKN from the LDEQ data. The organic nitrogen was then determined as TKN minus ammonia nitrogen. This yielded the following relationship that was used to develop model inputs:

Organic nitrogen = 0.83 * TKN

3.12 Model Results for Calibration

Plots of predicted and observed water quality for the calibration are presented in Appendix F and a printout of the LA-QUAL output file is included as Appendix G. The calibration was considered to be acceptable based on the amount of data that were available.

4.0 WATER QUALITY MODEL PROJECTION

EPA's regulations at 40 CFR 130.7 require the determination of TMDLs to take into account critical conditions for stream flow, loading, and water quality parameters. Therefore, the calibrated model was used to project water quality for critical conditions. The identification of critical conditions and the model input data used for critical conditions are discussed below.

4.1 Identification of Critical Conditions

Section 303(d) of the Federal Clean Water Act and EPA's regulations at 40 CFR 130.7 both require the consideration of seasonal variation of conditions affecting the constituent of concern and the inclusion of a MOS in the development of a TMDL. For the TMDLs in this report, analyses of LDEQ long-term ambient data were used to determine critical seasonal conditions. A combination of implicit and explicit MOS was used in developing the projection model.

Critical conditions for DO have been determined for the Mermentau basin in previous TMDL studies. The analyses concluded that the critical conditions for stream DO concentrations occur during periods with negligible nonpoint runoff, low stream flow, and high stream temperature.

When the rainfall runoff (and nonpoint loading) and stream flow are high, turbulence is higher due to the higher flow and the stream temperature is lowered by the cooler precipitation and runoff. In addition, runoff coefficients are higher in cooler weather due to reduced evaporation and evapotranspiration, so that the high flow periods of the year tend to be the cooler periods. DO saturation values are, of course, much higher when water temperatures are cooler, but BOD decay rates are much lower. For these reasons, periods of high loading are periods of higher reaeration and DO but not necessarily periods of high BOD decay.

LDEQ interprets this phenomenon in its TMDL modeling by assuming that the annual nonpoint loading, rather than loading for any particular day, is responsible for the accumulated benthic blanket of the stream, which is, in turn, expressed as SOD and/or resuspended BOD in the model. This accumulated loading has its greatest impact on the stream during periods of higher temperature and lower flow.

According to the LTP, critical summer conditions in DO TMDL projection modeling are simulated by using the annual 7Q10 flow or 0.1 cfs, whichever is higher, for all headwaters, and 90th percentile temperature for the summer season. Model loading is from point sources, perennial tributaries, SOD, and resuspension of sediments. In addition, all point sources are assumed to be discharging at design capacity.

In reality, the highest temperatures occur in July-August, the lowest stream flows occur in October-November, and the maximum point source discharge occurs following a significant rainfall, i.e., high-flow conditions. The combination of these conditions plus the impact of other conservative assumptions regarding rates and loadings yields an implicit MOS that is not quantified. Over and above this implicit MOS, an explicit MOS of 20% for point sources and 10% for NPS was incorporated into the TMDLs in this report to account for future growth and model uncertainty.

4.2 Temperature Inputs

The LTP (LDEQ 2000b) specified that the critical temperature should be determined by calculating the 90th percentile seasonal temperature for the waterbody being modeled. Because neither of the LDEQ stations in the study area had more than 6 months of data, LDEQ data from another subsegment were used for this analysis. In the Mermentau River TMDL (LDEQ 1999), long term temperature data from the Mermentau River at Mermentau (LDEQ station 0003) were used to calculate a 90th percentile summer temperature of 28.7ºC. However, the water temperatures for the Mermentau River station during June – December 1998 were slightly cooler than temperatures in the study area during that time. Therefore, the critical temperature for each subsegment in the study area was estimated as the 90th percentile summer temperature for the Mermentau River (28.7ºC) plus the average temperature difference during June – December 1998 between that subsegment and the Mermentau River station. These values were specified in data type 11 in the model input and are shown in Appendix H.

Because both subsegments in the study area have a year round standard for DO, a winter projection simulation was not performed. As discussed above, the most critical time of year for meeting a constant DO standard is the period of high temperatures and low flows (i.e., summer).

4.3 Headwater and Tributary Inputs

According to the LTP, the critical flow rates for summer should be set to either the 7Q10 flow or 0.1 cfs, whichever is higher. For this system, it was assumed that water levels during the calibration period were representative of 7Q10 conditions. This assumption was based on analyses of water levels in the lower Mermentau basin during late summer and early fall 1998 for the Lake Arthur / Grand Lake / Gulf Intracoastal Waterway TMDL (FTN 2001b). Therefore, the headwater flow for the projection was set to zero (the same as for the calibration). The flow rate for the Louisiana coastal current was assumed to be the same as in the calibration. The values used as model input in the projection simulation are shown in Appendix H.

4.4 Point Source Inputs

As mentioned in Section 3.9, no point source discharges were simulated in this model.

4.5 Nonpoint Source Loads

Because the initial projection simulation was showing low DO values in both reaches, the NPS loadings were reduced until the predicted DO values were equal to or greater than the water quality standards. Within each reach, the same percent reduction was applied to all components of the NPS loads (SOD and mass loads of CBODu and ammonia nitrogen). The values used as model input in the projection simulation are shown in Appendix H.

4.6 Downstream Boundary

Input values for the downstream boundary conditions were the same in the projection as in the calibration except for temperature, DO, ammonia nitrogen, and nitrate+nitrite. The temperature was set to the same as the critical temperature for subsegment 050901. This was done so that the model would not change the temperature that was specified for the Gulf Waters subsegment (050901). The DO value was set to 5.0 mg/L as a conservative value. Measured data showed DO values greater than 5 mg/L. The values used as model input in the projection simulation are shown in Appendix H.

4.7 Reaeration

Reaeration for the projection simulation was calculated based on long-term average wind speed (as opposed to using wind speed for specific days for the calibration). The long-term average wind speeds for the months of September and October at Lake Charles (the same station used for the calibration) were 6.9 mph and 5.9 mph, respectively. These 2 values were averaged and then used to calculate a wind-aided reaeration coefficient in the same manner as for the calibration. The values used as model input in the projection simulation are shown in Appendix H.

4.8 Other Inputs

The only model inputs that were changed from the calibration to the projection simulation were the inputs discussed above in Sections 4.2 through 4.7. All of the other model inputs (e.g., hydraulic and dispersion coefficients, decay rates, etc.) were unchanged from the calibration simulation.

4.9 Model Results for Projection

Plots of predicted water quality for the projection are presented in Appendix I and a printout of the LA-QUAL output file is included as Appendix J.

For the Big Constance Lake subsegment, a NPS load reduction of 48% was required to meet the DO standard of 4.0 mg/L. For the Gulf Waters subsegment, a NPS load reduction of 97% was required to meet the DO standard of 5.0 mg/L. These percentage reductions for NPS loads represent percentages of the entire NPS loading, not percentages of the manmade NPS loading. The NPS loads in this report were not divided between natural and manmade because it would be difficult to estimate natural NPS loads for the waterbodies in the study area. There are no LDEQ reference streams in the lower Mermentau basin and the waterbodies in the study area are much different than reference streams in other parts of the state.

5.0 TMDL CALCULATIONS

5.1 DO TMDLs

A total maximum daily load (TMDL) for DO has been calculated for each subsegment in the study area based on the results of the projection simulation. The DO TMDLs are presented as oxygen demand from CBODu, organic nitrogen, ammonia nitrogen, and SOD. Summaries of the loads for each subsegment are presented in Tables 5.1 and 5.2.

Table 5.1. DO TMDL for Subsegment 050802 (Big Constance Lake).

	Oxygen demand (kg/day) from:				
Source of Oxygen Demand	CBODu	Organic N	Ammonia N	SOD	Total Oxygen Demand (kg/day)
WLA for point sources	0.20	1.48	0.74	n.a.	2.42
MOS for point sources	0.05	0.37	0.18	n.a.	0.60
LA for NPS	4078.80	342.94	0.00	378172.84	382594.59
MOS for NPS	453.20	38.10	0.00	42019.20	42510.51
Total Maximum Daily Load	4532.25	382.89	0.92	420192.04	425108.12

Table 5.2. DO TMDL for Subsegment 050901 (Mermentau Coastal Bays and Gulf Waters).

	Oxygen demand (kg/day) from:				
Source of Oxygen Demand	CBODu	Organic N	Ammonia N	SOD	Total Oxygen Demand (kg/day)
WLA for point sources	0.00	0.00	0.00	n.a	0.00
MOS for point sources	0.00	0.00	0.00	n.a	0.00
LA for NPS	3143.41	666.67	12.12	100331.98	104154.19
MOS for NPS	349.27	74.07	1.35	11148.00	11572.69
Total Maximum Daily Load	3492.68	740.74	13.47	111479.98	115726.88

The oxygen demand from organic nitrogen and ammonia nitrogen was calculated as 4.33 times the organic nitrogen and ammonia nitrogen (assuming that all organic nitrogen is eventually converted to ammonia). The value of 4.33 is the same ratio of oxygen demand to nitrogen that is used by the LA-QUAL model. For the SOD loads, a temperature correction factor was included in the calculations (in order to be consistent with LDEQ procedures).

The WLAs for minor point sources represent the loads from small oxygen demanding discharges that were not explicitly modeled. For these 2 subsegments, there was only one small oxygen demanding discharge (permit number WP2513). The WLA for this discharge was based on current permit limits and design flow with no reductions. Because this discharge did not have a permit limit for ammonia nitrogen, an effluent concentration of 15 mg/L of ammonia nitrogen was assumed based on the existing BOD_5 permit limit (45 mg/L) and typical combinations of BOD_5 and ammonia nitrogen listed in the LTP (LDEQ 2000b). The design flow for this facility is 0.0005 MGD.

Because the WLAs for minor point sources represented loads that were not simulated in the model, these loads were included in the TMDL by adding their oxygen demand to the total load simulated in the model. The LAs for NPS were calculated as 90% of the NPS load simulated in the model. The other 10% of the NPS load simulated in the model was designated as an explicit MOS for NPS. The explicit MOS for point sources was set to 20% of the total point source loading.

5.2 Nutrient TMDLs

Because the Gulf Waters subsegment (050901) was on the 303(d) List for nutrients as well as DO (see Table 1.1), nutrient TMDLs were also developed. As discussed in Section 2.2, Louisiana has no numeric standards for nutrients, but has a narrative standard that states that "the naturally occurring range of nitrogen-phosphorus ratios shall be maintained" (LDEQ 2000a). For these TMDLs, nutrients were defined as total inorganic nitrogen (ammonia nitrogen plus nitrate/nitrite nitrogen) and total phosphorus. The value used for the naturally occurring nitrogen to phosphorus ratio was 1.96, which was the median ratio of total inorganic nitrogen to total phosphorus from historical data that was analyzed for a previous nutrient TMDL for the Lake Fausse Pointe/Dauterive Lake system (FTN 2000b).

The first step in calculating the nutrient TMDLs was to determine the loads of total inorganic nitrogen (TIN) that were simulated in the projection model. The loads in the projection model represent the maximum allowable loads that will maintain DO standards. Then the allowable loads of total phosphorus (TP) were calculated by dividing the nitrogen loads by the naturally occurring ratio of TIN to TP (which was 1.96 as discussed above). The resulting loads of TIN and TP for each subsegment are presented in Tables 5.3 and 5.4.

Table 5.3. Nutrient TMDL for Subsegment 050802 (Big Constance Lake).

Source of Nutrients	Ammonia N (kg/day)	NO2+NO3 N (kg/day)	Inorganic N (kg/day)	Total P (kg/day)
WLA for point sources	0.17	0.02	0.19	0.10
MOS for point sources	0.04	0.00	0.04	0.02
LA for NPS	0.00	0.00	0.00	0.00
MOS for NPS	0.00	0.00	0.00	0.00
Total Maximum Daily Load	0.21	0.02	0.23	0.12

Table 5.4. Nutrient TMDL for Subsegment 050901 (Mermentau Coastal Bays and Gulf Waters).

Source of Nutrients	Ammonia N (kg/day)	NO2+NO3 N (kg/day)	Inorganic N (kg/day)	Total P (kg/day)
WLA for point sources	0.00	0.00	0.00	0.00
MOS for point sources	0.00	0.00	0.00	0.00
LA for NPS	2.80	11.20	14.00	7.14
MOS for NPS	0.31	1.24	1.55	0.79
Total Maximum Daily Load	3.11	12.44	15.55	7.93

5.3 Summary of NPS Reductions and Point Source Upgrades

In summary, the projection modeling used to develop the TMDLs above showed that NPS loads need to be reduced as follows to maintain the DO standard:

71% – Subsegment 050802 (Big Constance Lake)
97% – Subsegment 050901 (Mermentau Coastal Bays and Gulf Waters)

Because the only oxygen demanding point source was very small, no point source reductions are necessary in order to meet water quality standards.

5.4 Seasonal Variation

As discussed in Section 4.1, critical conditions for DO in Louisiana waterbodies have been determined to be when there is negligible nonpoint runoff and low stream flow combined with high water temperatures. In addition, the models account for loadings that occur at higher flows by modeling SOD and resuspended CBOD and organic nitrogen. Oxygen demanding pollutants that enter the waterbodies during higher flows settle to the bottom and then exert the greatest oxygen demand during the high temperature seasons.

5.5 Margin of Safety

The MOS accounts for any lack of knowledge or uncertainty concerning the relationship between LAs and water quality. As discussed in Section 4.1, the highest temperatures occur in July and August, the lowest stream flows occur in October and November, and the maximum point source discharge occurs following a significant rainfall, i.e., high-flow conditions. The combination of these conditions, in addition to other conservative assumptions regarding rates and loadings, yields an implicit MOS that is not quantified. In addition to the implicit MOS, the TMDLs in this report included explicit margins of safety of 20% for point source loads and 10% for NPS loads.

6.0 SENSITIVITY ANALYSES

All modeling studies necessarily involve uncertainty and some degree of approximation. It is therefore of value to consider the sensitivity of the model output to changes in model coefficients, and in the hypothesized relationships among the parameters of the model. The sensitivity analyses were performed by allowing the LA-QUAL model to vary one input parameter at a time while holding all other parameters to their original value. The projection simulation was used as the baseline for the sensitivity analysis. The percent change of the model's minimum DO projections to each parameter is presented in Table 6.1. Each parameter was varied by ±30%, except for temperature, which was varied ±2ºC.

Values reported in Table 6.1 are sorted by percentage variation of minimum DO from smallest percentage variation to largest. Reaeration (7% to 10%), SOD (6%) and initial temperature (6%) were the parameters to which DO was most sensitive. The model was not sensitive to other parameters.

Table 6.1. Summary of results of sensitivity analyses.

Input Parameter	Parameter Change	Predicted minimum DO (mg/L)	Percent Change in Predicted DO (%)
Baseline	-	4.47	N/A
Dispersion	+30%	4.47	<1%
Dispersion	-30%	4.47	<1%
Headwater flow	+30%	4.47	<1%
Headwater flow	-30%	4.47	<1%
Waste Load BOD	+30%	4.47	<1%
Waste Load BOD	-30%	4.47	<1%
Waste Load DO	+30%	4.47	<1%
Waste Load DO	-30%	4.47	<1%
Waste Load flow	+30%	4.47	<1%
Waste Load flow	-30%	4.47	<1%
Waste Load NH3	+30%	4.47	<1%
Waste Load NH3	-30%	4.47	<1%
Waste Load Organic N	+30%	4.47	<1%
Waste Load Organic N	-30%	4.47	<1%
Organic N decay rate	+30%	4.46	<1%
Organic N decay rate	-30%	4.48	<1%
NH3 decay rate	+30%	4.45	<1%
Velocity	+30%	4.45	<1%
Depth	-30%	4.49	<1%
NH3 decay rate	-30%	4.49	<1%
Velocity	-30%	4.50	1%
Depth	+30%	4.42	1%
BOD decay rate	+30%	4.38	2%
BOD decay rate	-30%	4.58	2%
Initial Temperature	-2^{o}C	4.73	6%
Initial Temperature	+2^{o}C	4.20	6%
SOD	+30%	4.18	6%
SOD	-30%	4.76	6%
Reaeration	+30%	4.77	7%
Reaeration	-30%	4.04	10%

7.0 OTHER RELEVANT INFORMATION

This TMDL has been developed to be consistent with the antidegradation policy in the LDEQ water quality standards (LAC 33:IX.1109.A).

Although not required by this TMDL, LDEQ utilizes funds under Section 106 of the federal Clean Water Act and under the authority of the Louisiana Environmental Quality Act to operate an established program for monitoring the quality of the state's surface waters. The LDEQ Surveillance Section collects surface water samples at various locations, utilizing appropriate sampling methods and procedures for ensuring the quality of the data collected. The objectives of the surface water monitoring program are to determine the quality of the state's surface waters, to develop a long-term data base for water quality trend analysis, and to monitor the effectiveness of pollution controls. The data obtained through the surface water monitoring program is used to develop the state's biennial 305(b) report (Water Quality Inventory) and the 303(d) List of impaired waters. This information is also utilized in establishing priorities for the LDEQ NPS program.

The LDEQ has implemented a watershed approach to surface water quality monitoring. Through this approach, the entire state is sampled over a five-year cycle with two targeted basins sampled each year. Long-term trend monitoring sites at various locations on the larger rivers and Lake Pontchartrain are sampled throughout the five-year cycle. Sampling is conducted on a monthly basis or more frequently if necessary to yield at least 12 samples per site each year. Sampling sites are located where they are considered to be representative of the waterbody. Under the current monitoring schedule, targeted basins follow the TMDL priorities. In this manner, the first TMDLs will have been implemented by the time the first priority basins will be monitored again in the second five-year cycle. This will allow the LDEQ to determine whether there has been any improvement in water quality following establishment of the TMDLs. As the monitoring results are evaluated at the end of each year, waterbodies may be added to or removed from the 303(d) List. The sampling schedule for the first five-year cycle is shown below. The Mermentau and Vermilion-Teche River Basins will be sampled again in 2003.

1998 – Mermentau and Vermilion-Teche River Basins
1999 – Calcasieu and Ouachita River Basins
2000 – Barataria and Terrebonne Basins
2001 – Lake Pontchartrain Basin and Pearl River Basin
2002 – Red and Sabine River Basins

(Atchafalaya and Mississippi Rivers will be sampled continuously.)

In addition to ambient water quality sampling in the priority basins, the LDEQ has increased compliance monitoring in those basins, following the same schedule. Approximately 1,000 to 1,100 permitted facilities in the priority basins were targeted for inspections. The goal set by LDEQ was to inspect all of those facilities on the list and to sample 1/3 of the minors and 1/3 of the majors. During 1998, 476 compliance evaluation inspections and 165 compliance sampling inspections were conducted throughout the Mermentau and Vermilion-Teche River Basins.

8.0 PUBLIC PARTICIPATION

When EPA establishes a TMDL, 40 CFR §130.7(d)(2) requires EPA to publicly notice and seek comment concerning the TMDL. Pursuant to an October 1, 1999 Court Order, this TMDL was prepared under contract to EPA. After submission of this TMDL to the Court, EPA commenced preparation of a notice seeking comments, information, and data from the general and affected public. Comments and additional information were submitted during the public comment period and this Court Ordered TMDL was revised accordingly. Responses to these comments and additional information are included in Appendix L. EPA has transmitted this revised TMDL to the Court and to LDEQ for incorporation into LDEQ's current water quality management plan.

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APPENDICES A THROUGH K ARE AVAILABLE FROM EPA UPON REQUEST

APPENDIX L

Response to Comments

COMMENTS AND RESPONSES
BIG CONSTANCE LAKE / MERMENTAU COASTAL WATERS
TMDLs FOR DO AND NUTRIENTS
April 2002

EPA appreciates all comments concerning these TMDLs. Comments that were received are shown below with EPA responses inserted in a different font.

COMMENTS FROM EARTHJUSTICE ON BEHALF OF SIERRA CLUB AND LOUISIANA ENVIRONMENTAL ACTION NETWORK (LEAN):

I. Introduction

The Sierra Club and LEAN appreciate EPA's efforts to comply with the Consent Decree in the Louisiana TMDL case, Sierra Club, et al. v. Clifford. et al., USDC-ED-LA No. 96-0527-S-4, which led to the development of these TMDLs, and we hope that you will use the additional information provided in these comments to modify and improve the TMDLs before final action is taken on the TMDLs, i.e. before they are established.

As demonstrated below, these TMDLs impact the enormous hypoxic zone off the Louisiana coast, commonly known as the "Dead Zone." Scientific research has established that nutrient enrichment in the Mississippi and Atchafalaya Rivers, and other rivers in Louisiana, primarily from nonpoint sources, cause a massive area of oxygen depletion that forms each summer off the coast of Louisiana. This Dead Zone threatens marine and coastal resources upon which tens of thousands of Americans depend for their livelihoods. Because these TMDLs cover a portion of the Dead Zone, they are of great importance. Moreover, these TMDLs present the opportunity for EPA to make significant progress on this longstanding water quality problem.

II. The TMDLs Should be Modified to Specifically Address Sources and Solutions for the Dead Zone

This opportunity for EPA to address the hypoxic zone in the Gulf of Mexico must not be lost.

A. The Gulf and the Dead Zone

The Central Gulf of Mexico is one of the most vital ecological systems on the North American continent. The Central Gulf is flanked on the north by Louisiana’s coastal marshes, which comprise some 40% of the coastal wetlands remaining in the United States. The shallow waters of the Gulf act as a nursery for shrimp, fish, and other marine life. The Central Gulf is a tremendous national economic and recreational treasure. This area produces approximately 40% of the United States' commercial fishing yield; sustains a substantial part of the nation's most valuable fishery -- shrimp; provides, with its associated wetlands, critical habitat for 75% of the migratory waterfowl in the country; and serves as an important recreational resource for the residents of and visitors to the southern states.

Response #1: EPA agrees with the statements concerning the value and importance of the Gulf of Mexico, and acknowledges the seriousness and far-reaching impacts of hypoxia in the Gulf. This complex environmental issue is of national importance and its causes and solutions are nationally significant. Federal agencies and State and Tribal representatives within the Mississippi River Basin are addressing the hypoxia issue through the Mississippi River/Gulf of Mexico Watershed Nutrient Task Force (Task Force). The Task Force is beginning implementation of their "Action Plan for Reducing, Mitigating, and Controlling Hypoxia in the Northern Gulf of Mexico" which was submitted to Congress in January 2001.

EPA is currently addressing implementation of the Action Plan and the hypoxia issue through work being done with the Task Force and within EPA at Regions 3-8, the Gulf of Mexico Program Office, and EPA Headquarters. EPA Region 6 has recently created a new position of Chief Policy Advisor for Coastal Affairs. This new Region 6 position has been modeled after the Senior Leader positions created by Governor Whitman to address important Agency initiatives, and will be added to Senior Staff here in Region 6. Sam Becker, the current acting Director of the Water quality Protection Division will assume this role. Nationally, EPA has committed to take new steps to address coastal issues highlighted in the recent coastal report. Here in Region 6, we and our State partners believe that heightened senior level attention can make a significant positive difference along the Louisiana and Texas coastline.

The Central Gulf of Mexico is also the final discharge point of the Mississippi and Atchafalaya Rivers, and various other waterbodies in Louisiana. The Mississippi River, of course, is the largest river in North America -- draining some 41% of the continent -- and one of the largest rivers in the world. Sediments and nutrients from the Mississippi River built the wetlands which help make the Central Gulf so productive a system. Ironically, it is the excess of man-introduced nutrients in the river that now threaten that very system.

Scientists first observed the occurrence of a huge area of oxygen-depleted water in the Gulf of Mexico off the Louisiana coast in the early 1970s. In the years since that time, this phenomenon has been the subject of extensive study, and the dimensions and effects of the Dead

Zone are now better known. Although the dimensions of the Dead Zone vary from year to year, it typically covers an area of approximately 3500 square miles stretching west from the mouth of the Mississippi River toward the Texas border. For a detailed description of the size and extent of the Dead Zone and its relation to Louisiana's waters, see Attachment A, Rabalais, et al., 1999, "Characterization of Hypoxia." Additional recent studies have confirmed the Dead Zone's existence, location, and cause. See, Attachment B.

Portions of the Dead Zone are found within Louisiana state boundaries -- including the Mermentau Coastal Bays and Gulf Waters covered in the instant TMDLs. The Dead Zone is described in Louisiana's Clean Water Act § 305(b) Reports to EPA. It is also included in Louisiana's Clean Water Act § 303(d) list of impaired waters. In addition, the State of Mississippi lists the Mississippi River on its § 303(d) list as not meeting standards due to excessive nutrients from upstream. (All of these Louisiana and Mississippi reports and lists are available from EPA, and are incorporated here by reference.)

Response #2: EPA acknowledges the existence of the hypoxic zone in waters of the Gulf of Mexico and that it may exert influences within some Louisiana coastal subsegments. However, EPA does not agree that sufficient data has been submitted to demonstrate that portions of the hypoxic zone are found within the Mermentau Coastal Bays and Gulf Waters subsegment. During the comment period, the Gulf Restoration Network (GRN) submitted data (SW-LA.N.Rabalais.Data.Dead.Zone.TMDL.xls) purported to include information that portions of the dead zone are found within the coastal waters subsegment (050901). EPA's evaluation of this data, shows that this data set consists largely of stations that are outside the 3-mile limit established in the Louisiana Water Quality Standards as the southern boundary of subsegment 050901.

From this data set, five stations were determined to be within the boundaries of subsegment 050901. Both bottom and surface dissolved oxygen measurements were taken at each station and these results are provided in Table 1 below. Of these data, acknowledged to be within subsegment 050901, all surface measurements were above 5 mg/L and 4 of the 5 bottom measurements were above 5 mg/L. The only value that was below 5 mg/L was a bottom measurement of 4.84 mg/L. While this value is less than the DO criterion it does not meet the generally accepted 2 mg/L definition of hypoxic conditions.

In 1998, LDEQ established water quality station 662, to assess compliance of subsegment 050901 with State water quality criterion. This station is located at the end of land near the outlet for Joseph Harbor Bayou. DO at this station is dominated by conditions in the marshes along the coast rather than by hypoxic conditions the result of loadings from the Mississippi and Atchafalaya Rivers.

Twelve measurements were collected by LDEQ at station 0662 during June - December 1998 (shown in Appendix D of the report). This data is the basis for the continued listing and for the TMDL.

Based on information in "Characterization of Hypoxia" (submitted as Attachment A to these comments), EPA acknowledges that the hypoxic zone may extend close to the edge of subsegment 050901 in some years. However, EPA does not find that any information or data submitted support the assertion that hypoxic conditions may have caused or contributed to the low DO values in the LDEQ data set which serve as the basis for EPA's TMDL or that this subsegment is impaired due to the hypoxia phenomenon.

And as explained below (see Response #9), EPA did consider this data set, in that we evaluated those stations with data within the areas of concern and evaluated the coastal waters portion of the model to determine if it was appropriate to use the submitted data to revise the TMDL model's southern boundary condition. EPA considered data submitted by GRN to evaluate the model's southern boundary condition. Surface measurements from this data set were markedly higher than EPA's original value, demonstrating that EPAs use of a 5 mg/L value for the projection was conservative. EPA decided to keep the more conservative approach in the model by keeping a 5.0 mg/L dissolved oxygen value for the boundary condition. However, EPA believes that this data, along with any additional data related to this subsegment or data from the hypoxia sampling program, if determined to be existing and readily available data and information, should be considered in the development of the 2002 section 303(d) list. In developing Section 303(d) lists, EPA's regulations direct the States to consider "all existing and readily available water quality-related data and information." EPA will provide the commenters' data to the State for such consideration, as appropriate, during the 2002 listing cycle.

Table 1. DO data within subsegment 050901 from GRN spreadsheet.

Surface or Bottom	Station	Date	Measur. depth (m)	Temp. (C)	DO (mg/L)	Latitude (decimal degrees)	Longitude (decimal degrees)
Surface	P921050a	4/25/92	1.062	23.71	6.70	29.5948	92.7500
Surface	P922158a	10/9/92	2.268	23.15	6.67	29.5935	92.7492
Surface	P931140a	4/15/93	1.510	20.22	7.71	29.5928	92.7485

Surface	P932144	7/16/93	1.415	29.20	7.02	29.5940	92.7508
Surface	P942144a	7/14/94	1.262	29.52	7.62	29.5923	92.7502
Bottom	P921050a	4/25/92	1.631	23.71	6.79	29.5948	92.7500
Bottom	P922158a	10/9/92	5.021	23.30	6.23	29.5935	92.7492
Bottom	P931140a	4/15/93	4.656	19.95	7.30	29.5928	92.7485
Bottom	P932144	7/16/93	5.400	29.12	4.84	29.5940	92.7508
Bottom	P942144a	7/14/94	5.558	29.18	6.99	29.5923	92.7502

Within the Dead Zone oxygen content in the water layers along the bottom is less than 2 milligrams per liter (mg/l) -- insufficient to sustain most marine life. As a result, mobile aquatic organisms such as fish avoid these areas. Less mobile creatures, such as the sediment-dwelling creatures that form the basis of the marine food chain, are severely stressed or simply die. Bottom trawls in these locations show only dead and decomposing fish and shrimp. See, Attachment C.

The causes of the Dead Zone phenomenon are known. Increased plankton production in the Central Gulf is correlated with the increase in nutrients since the 1950s. This increased plankton production leads directly to the production of the vast Dead Zone. Organic matter -- particularly unicellular organisms such as plankton -- falls to the bottom and decays, using up the available oxygen in the bottom layer of water. This is established in detail in Attachment C.

By the time it reaches Louisiana, the Mississippi River is the subject of massive nutrient enrichment from nonpoint as well as point sources. The biennial reports submitted by the states under the Clean Water Act reflect that nutrient pollution, often from agricultural sources, is a leading cause of water quality limitations in those states in the Mississippi River watershed. Agricultural pollution is typically cited as one of the largest sources -- if not the largest source -- of pollutants causing water quality violations. The State of Louisiana also contributes significant nutrient loading to waters that flow into the Gulf of Mexico. See, e.g., Louisiana's reports to the U.S. Environmental Protection Agency pursuant to Clean Water Act §§ 305(b), 319 and 303(d), all of which are incorporated here, in full, by reference. An analysis of nutrient inputs to the Gulf of Mexico performed for the EPA's Gulf of Mexico program specifically found that the State of Louisiana contributes 2% to 5% of the nutrient load to the Dead Zone. Attachments D-l and D-2, Goolsby, et al., 1999, "Flux and Sources of Nitrates in the Mississippi-Atchafalaya River Basin."

In addition, research into historical nutrient loads in the Mississippi River clearly shows that the nutrient loads in the river have risen in tandem with greatly increased use of agricultural chemicals in the Mississippi River watershed. There has been a large increase in nitrate loading in the Mississippi River from the early part of this century. This increase is significantly correlated with the increased use of fertilizers in recent decades. There is a spring peak in nitrate levels, which is thought to be related to fertilizer application. See, Attachments C, D-l, and D-2, and for further discussion of this; see, Turner and Rabalais, "Changes in Mississippi River Water Quality this Century," 41 Bioscience 140 (1991).

In addition to agricultural sources, urban runoff, construction sites, and other nonpoint sources often contain significant nutrient loads. All of these nonpoint sources must be addressed to create a lasting solution to this severe problem. Controlling and reducing nutrients in Louisiana and the upstream states is a necessary step toward reducing excessive nutrients in the Dead Zone, and, thus, to an attainment of water quality standards in these federal and state waters. See, Attachment E, Brezonik, et al., 1999, "Effects of Reducing Nutrients Loads within the Mississippi River Basin and the Gulf of Mexico."

Response #3: The TMDL established by EPA for subsegment 050901 will lead to reductions in oxygen demanding substances, including nutrients, that are the result of watershed activities in the lower Mermentau basin. This TMDL, as established, will reduce overall nutrient burdens to the Gulf of Mexico. EPA agrees that hypoxia in the Gulf of Mexico is a problem of large proportions and should be addressed on a national scale. As the commenter states only 2-5% of the nutrient load to the Gulf of Mexico comes from Louisiana. EPA is currently addressing the broader issue of hypoxia in the Gulf of Mexico through work being done at both EPA Region 6 and EPA Headquarters. See response #1.

B. The Nutrient Overload in Coastal Waters Violates Louisiana Water Quality Standards

Like all other states, Louisiana has promulgated, after public notice and comment, water quality standards that are aimed at ensuring that waters of the state meet their intended uses.

As noted in the TMDLs, Louisiana's water quality standards for the Mississippi River and the Gulf waters off the Louisiana coast specifically address organic nutrients and oxygen levels. Louisiana Administrative Code Title 33, § 1113(B)(8) provides that in all Louisiana waters, including the Mississippi River, "[t]he naturally occurring range of nitrogen-phosphorus rations shall be maintained." Section 1113(C)(3)(c) provides as follows with respect to dissolved oxygen levels in the near shore Gulf of Mexico:

> Dissolved oxygen concentrations in coastal waters shall not be less than 5 mg/l, except when upwellings and other natural phenomena cause this value to be lower.

Louisiana's water quality standards also provide generally that waters shall be free of "concentrations of substances attributable to wastewater or other discharges sufficient to . . . injure, be toxic, or produce demonstrated adverse physiological or behavioral responses in humans, animals, fish, shellfish, wildlife or plants . . ." Id.

The addition of massive quantities of nutrients, as described above, has caused the Mississippi River to have a nutrient load far different from its natural load. In addition, the role of this nutrient load in causing the anoxic waters of the Dead Zone constitutes a violation of the dissolved oxygen standard for near shore marine waters, which states that oxygen levels shall be below 5 mg/l except as a result of natural causes. The Dead Zone is by definition waters with less than 2 mg/l of oxygen. Finally, the effect of this nutrient load is to injure the marine life of the Central Gulf of Mexico on a grand scale. Consequently, nonpoint nutrient pollution from upstream states is, without question, causing a violation of water quality standards in Louisiana and this fact should be reflected in the TMDL.

In addition, the Dead Zone extends well out into federal waters overlying the Outer Continental Shelf ("OCS") adjacent to Louisiana. Pursuant to the Outer Continental Shelf Lands Act, 43 U.S.C. § 1332(b), state laws are adopted as federal law for the OCS to the extent they are not inconsistent with federal law. There is no federally promulgated nutrient or oxygen water quality standard for the Louisiana OCS. Consequently, the Louisiana dissolved oxygen and nutrient standards would be adopted as federal law for the Louisiana OCS. Thus, nutrient enrichment and the associated oxygen depletion are causing violations of federal law on the OCS, as well.

Response #4: As mentioned in response #1, EPA acknowledges the existence and seriousness of hypoxia in the Gulf of Mexico and is committed to working to develop solutions. EPA is not responding today to the comment on the applicability of the Outer Continental Shelf Lands Act because EPA determined that the hypoxic zone does not impact the segment for which the TMDL is being established.

III. The TMDLs Should Be Modified to Address Implementation

The Mermentau Coastal Bays and Gulf Waters TMDLs include no implementation plans, or identification of implementation measures of any sort. Such are required under EPA's 1997 directives to the States and should be done by EPA in its TMDLs, as well. The EPA's August 8, 1997 TMDL Policy Memorandum to all EPA Regional Directors states:

> These policies supplement existing regulations and guidance, and will remain in effect unless they are specifically changed by the Office of Water. . . . In watersheds impaired by a blend of point and nonpoint sources, [the 1991] TMDL Process guidance document provides . . . the State must provide "reasonable assurances" that the nonpoint source load allocations will in fact be achieved. ... Our current regulations, guidance and policies remain unchanged regarding implementation of TMDLs for those waters impaired by point sources or by a blend of point and nonpoint sources in which point sources dominate. . . .
>
> *For all section 303(d) listed waters impaired solely or primarily by nonpoint sources, each State should describe its plan for implementing load allocations for*

nonpoint sources . . . States may submit implementation plans to EPA as revisions to State water quality plans, coupled with a proposed TMDL, or as part of an equivalent watershed or geographic planning process. At a minimum, each State implementation plan should include

- *Reasonable assurances that the nonpoint source load allocations established in TMDLs (for waters impaired solely or primarily by nonpoint sources) will in fact be achieved. These assurances may be non-regulatory, regulatory, or incentive-based consistent with applicable laws and programs. . . ;*

- *A public participation process; and*

- *Appropriate recognition of other relevant watershed management processes, such as local source water protection programs, urban storm water management programs, State section 319 management programs, or State section 303(e) continuing planning processes.*

(Italics in the original.)

In addition, although they are currently not in effect, EPA's new TMDL regulations (published in July 2000) interpreted the Clean Water Act to require implementation plans in TMDLs. <u>Please inform us as to when EPA intends to prepare these plans for these TMDLs</u>. At a minimum, the State of Louisiana's § 303(e) and § 319 plans, and those of the upstream states, must be revised to implement these TMDLs. Nevertheless, there is no indication in the TMDLs that that will be done, much less within a specified timeframe. Sierra Club and LEAN urge EPA to notify the upstream states of the necessity to do this, and to add an implementation section to these TMDLs to address all of these factors, before the TMDL is finally "established."

Response #5: These TMDLs were developed using federal funding during fiscal year 2001, during which time EPA was prohibited by Congress from using federal funds to develop implementation plans in TMDLs. Current regulations do not require an implementation plan as an element of the TMDL itself. In addition, EPA’s current regulations do not require reasonable assurances that the TMDL will be implemented.

EPA believes that implementation plans should be developed for these subsegments and others. However, these implementation plans ought to be developed with careful planning and significant input from various stakeholders, which is done most efficiently at the state and local level without the short time frames created by the Court for developing these TMDLs. While hypoxia is being addressed on a national scale, EPA believes it is more appropriate that implementation of these TMDLs be carried out on the state and local level since the available data indicate that the impairment in these subsegments is not due to the hypoxic zone (see response #2). LDEQ's nonpoint source program is actively addressing nonpoint source pollution problems throughout the state. The Louisiana Nonpoint Source Management Plan as revised in 2000, provides for priority targeting of water quality subsegments with established or approved TMDLs. (See http://www.nonpoint.deq.state.la.us and http://www.epa.gov/owow/nps/Section319III/LA.htm for success stories and examples of how the state is implementing the Nonpoint Source Management Plan).

COMMENTS FROM GULF RESTORATION NETWORK (GRN) DATED 11-14-01:

The GRN is a diverse coalition of 44 local, regional, and national organizations concerned about the short and long-term health of the Gulf of Mexico, and committed to restoring it to an ecologically and biologically sustainable condition. Members of the Network are located in each of the states along the Gulf of Mexico.

The Importance of these TMDLs in Relation to Hypoxia in the Gulf of Mexico

Hypoxia-- which occurs when dissolved oxygen levels fall below those necessary to sustain most animal life-- is an ongoing and ecologically-devastating threat to the rich and diverse fisheries and coastal resources found in the northern Gulf of Mexico (Gulf). Scientific research has shown that hypoxia in the Gulf is caused primarily by excess nitrogen delivered from the Mississippi-Atchafalaya River system. Research has also proven that nutrient inputs into the Gulf have increased dramatically since the 1950s, as a result of human activities. According to the "Integrated Assessment: Hypoxia in the Northern Gulf of Mexico" (Committee on Environment and Natural Resources (CENR), May 2000), three major changes in the Mississippi-Atchafalaya drainage basin have affected this flux in nutrient concentrations reaching the Gulf:

1) Landscape alterations such as deforestation and agricultural drainage;
2) River channelization for flood control and navigation; and
3) Major increases in fertilizer nitrogen input within the basin.

The following are excerpts from "Integrated Assessment: Hypoxia in the Northern Gulf of Mexico" (CENR, May 2000) and illustrate the magnitude of the Hypoxia problem and the associated ecological repercussions:

"Since 1980, the Mississippi and Atchafalaya Rivers have discharged, on average, about 1.6 million metric tons of total nitrogen to the Gulf each year. Total nitrogen load has increased since the 1950s, due primarily to an increase in nitrate nitrogen. Nitrogen flux to the Gulf of Mexico has almost tripled between the periods 1955-70 and 1980-96.

"About 90% of the nitrate load to the Gulf comes from nonpoint sources. About 56 % of the load enters the Mississippi River above the Ohio River, and the Ohio basin adds 34 percent. Principal sources are basins draining agricultural lands in Iowa, Illinois, Indiana, southern Minnesota, and Ohio.

"Gulf ecosystems and fisheries are affected by hypoxia. Mobile organisms leave the hypoxic zone for healthier waters, and those that can not leave die at varying rates, depending on how low the oxygen level gets and for how long. Fish, shrimp, zooplankton, and other important fish prey are significantly less abundant in hypoxic bottom waters."

As the CENR report illustrates, hypoxia (commonly referred to as the "Dead Zone") is a problem of gargantuan proportions, a problem that involves not only the resources of the Gulf of Mexico and the people whose livelihoods depend on these resources, but also the states throughout the Mississippi and Atchafalaya (M-A) Basin whose activities directly contribute to high nitrogen loading in the Gulf. The problem remains today an issue of national concern (as illustrated by the establishment of the Gulf Hypoxia Task Force) and is an issue that needs to be addressed by a collaborative effort by all of the states in the M-A Basin. We, therefore, request that states contributing to the Dead Zone problem be directly involved in the development and implementation of this TMDL.

Big Constance Lake (subsegment 050802) and Mermentau Coastal Bays and Gulf Waters (subsegment 050901) are both listed on the state's impaired waters list for not fully supporting the designated use of propagation of fish and wildlife due to organic enrichment and low dissolved oxygen (DO) and, for subsegment 050901, excess nutrients. Establishment and successful implementation of these TMDLs is paramount to avoiding the ecological devastation associated with continued hypoxic conditions in the Gulf.

Response #6: The TMDL established by EPA, for subsegment 050901, is intended to reduce oxygen demanding substances including nutrients that are the result of activities in the lower Mermentau basin. This TMDL will reduce overall nutrient burdens to the Gulf of Mexico. EPA agrees that hypoxia in the Gulf of Mexico is a problem of large proportions and should be addressed on a national scale. EPA is currently addressing nutrient loadings that contribute to hypoxia in the Gulf of Mexico through work being done at both EPA Region 6 and EPA Headquarters. Also see response #1.

TMDL Does Not Properly Address Dead Zone Problem

The models, the calibration data, and the eventual monitoring data for DO levels completed by LDEQ is all based on surface water, within 1 meter of the surface. It is obvious from the calibration data (included in Appendix D of the TMDL) that there are many instances in subsegments 050901 and 050802 where DO values are critically low in the water column within 1 meter of the surface (e.g., DO levels measured by DEQ were as low as 1.9 mg/L on 09/23/98 in subsegment 050901). Often, low DO is manifested in the lower water column, as a result of the loads that initially enter the surface waters. There is no consideration of the lower water column, or bottom water, DO conditions in this TMDL.

In order to ensure the ecosystem health and vitality in the two subsegments that are the subject of this TMDL, it is necessary for all modeling and data collection activities to address low oxygen conditions found in the lower water column. At present, this TMDL only addresses depleted oxygen levels and elevated nutrient levels at a 1 meter depth. However, it is the depleted DO in the bottom waters of the Gulf, the Dead Zone, that is endangering fish and coastal resources, and the people who depend on these resources for their livelihoods.

Response #7: Following guidance in Section 3.1 of the Louisiana TMDL Technical Procedures Manual (the "LTP"),the model was calibrated to data collected at a depth of either 1 meter or 1/2 the depth where the depth is less than 2 meters. Although EPA acknowledges that bottom DO values may be lower than DO values near the surface, EPA believes that the TMDL to maintain a DO of 5 mg/L based on data at a 1 meter depth will be sufficient to meet water quality standards.

Nutrient Inputs from the Mississippi and Atchafalaya River Systems Need to Be Considered in TMDL Model

Neither the TMDL document nor the model recognize the importance of Gulf of Mexico water flow from the east along the Louisiana Coastal Current, which entrains the discharge of the Atchafalaya River and possibly some of the Mississippi River. Below are excerpts from the Committee on Environment and Natural Resources (CENR) Topic #1 report, which demonstrate the importance of the influence of the Mississippi and Atchafalaya Rivers on the water quality in Gulf nearshore waters.

"The Mississippi and Atchafalaya rivers are the primary riverine sources of fresh water to the Louisiana continental shelf (Dinnel and Wiseman 1986) and to the Gulf of Mexico (80% of freshwater inflow from U.S. rivers to the Gulf; Dunn 1996). The discharge of the Mississippi River system is controlled such that 30% flows seaward through the Atchafalaya River Delta and 70% through the Mississippi River Delta. The former enters through two outlets into Atchafalaya Bay, a broad shallow embayment; the latter enters the Gulf through multiple outlets, some in deep water and some in shallow water. Approximately 53% of the Mississippi River Delta discharge flows westward onto the Louisiana shelf (U.S. Army Corps of Engineers 1974, Dinnel and Wiseman 1986), and the general flow of the Atchafalaya River effluent is to the west. …

"The less dense, fresh river discharge floats atop and mixes with the ambient coastal sea water. Initially, water enters the shelf as a buoyant plume near the river mouth. The plumes from Atchafalaya Bay and Southwest Pass of the Mississippi River Delta (and possibly other outlets of the Mississippi Delta) turn anticyclonically until they encounter the Louisiana coast (Wiseman et al. 1975). At this point they merge into a highly-stratified coastal current, the Louisiana Coastal Current, often referred to as the extended plume. The coastal current flows westward along the Louisiana coast much of the year. The buoyant, low salinity waters are separated from the waters of the mid-shelf region by a strong surface-to-bottom frontal zone that typically intersects the bottom near the 10-15 m isobath. …

"The seasonal mean circulation and surface salinity patterns within the Louisiana Coastal current were described by Cochrane and Kelly (1986). Downcoast flow occurs throughout most of the year in response to both the buoyancy forcing from river discharge and the winds that are generally from the east in spring, fall and winter over the Louisiana-Texas shelf (Gutierrez de Valasco and Winant 1996). A narrow band of low salinity surface water extends from the Mississippi River Delta to, at least, the Texas-Mexican border (Smith 1980). …

"The combined discharges of the Mississippi and Atchafalaya Rivers account for 80% of the total freshwater input to the U.S. Gulf (calculated from U.S. Geological Survey streamflow data for 37 U.S. streams discharging into the Gulf of Mexico, Dunn 1996). …

"Dunn (1996) calculated the nutrient inflows from 37 U.S. streams discharging into the Gulf of Mexico for water years 1972-1993. With respect to the 37 streams draining into the Gulf of Mexico (Texas - Florida), the combined flows of the Mississippi and Atchafalaya Rivers account for 80% of the total annual discharge and 91% of the estimated total nitrogen load. If only streams between Galveston Bay (Texas) and the Mississippi River Delta are considered, i.e., those most likely to influence the zone of hypoxia, the combined flows of the Mississippi and Atchafalaya Rivers account for 96% of the annual freshwater discharge and 98.5% of the total nitrogen load. Similar calculations for annual total phosphorus load are 88% of the total 37 streams and 98% of the streams between Galveston Bay and the Mississippi River Delta for the relative contribution of the Mississippi and Atchafalaya Rivers."

The above excerpts from the CENR report conclude that the water quality in the nearshore Gulf waters is controlled by the effluents of fresh water and nutrients from the Mississippi and Atchafalaya waters. Thus, the north-south 1-dimensional model that was used to establish nonpoint source allocations for this TMDL <u>does not adequately address</u>

the nutrient inputs that are entering the subsegments in an east-west direction (i.e., nutrients that are carried by the Louisiana Coastal Current in a westward direction along the coast of Louisiana and contribute to nutrient enrichment and low dissolved oxygen levels in nearshore Gulf waters, including the waters in subsegments 050901 and 050802). In order to properly account for both the east-west and north-south nutrient inputs associated with these water segments, a 2-dimensional model is necessary.

Response #8: The model has been revised to include a tributary input to the coastal waters portion of the model. This tributary input represents the westward flow of water from the area of the Mississippi and Atchafalaya Rivers towards the Mermentau coastal waters. The flow rate and water quality for this tributary are based on information in the CENR report referenced above and are documented in Section 3.8 of the revised TMDL report. As a result of revisions to the model, the coastal waters portion of the model was re-calibrated.

Downstream Boundary Conditions Inconsistent

On page 3-6 of the TMDL, the downstream boundary conditions are set for LDEQ 0697, Southwest Pass of Vermilion Bay. The Southwest Pass of the Vermillion Bay is located to the east of the water subsegments 050901 and 050802. However, because the TMDL used a north-south 1-dimensional model, the downstream boundary condition should be the Gulf of Mexico waters. On page 4-4 of the TMDL, the downstream boundary condition for DO is set at 5.0 mg/L "based on the assumption that the DO in the Gulf of Mexico beyond the state 3-mile limit would meet the standard for subsegment 050901." This statement implies that the Gulf of Mexico was, in fact, used as the downstream boundary condition. Thus, there is inconsistency in the definition of what the downstream boundary condition is.

Response #9: We agree that Gulf of Mexico waters are the appropriate downstream boundary. Data from Southwest Pass was used because there was no other open water data available to establish an appropriate down stream boundary. EPA considered data submitted by GRN to evaluate the model's southern boundary condition. Surface measurements from this data set were markedly higher than EPA's original value, demonstrating that EPAs use of a 5 mg/L value for the projection was conservative. EPA decided to maintain the more conservative approach in the model and by keeping a 5.0 mg/L dissolved oxygen value for the boundary condition.

All Nonpoint Source Loads Need to Be Identified to Ensure Implementation

Because the model used in the development of these TMDLs was based on a north-south 1-dimensional flow, headwaters and tributaries north of the Big Constance Lake and Mermentau coastal bays and Gulf waters were considered as nonpoint source contributors. However, since the flow rates of all headwaters and tributaries were set equal to zero, no nutrient inputs from headwaters or tributaries were considered in this model. Because no explicit origin of nutrient loads was included in the TMDL, these loads are modeled as a resuspended load from the bottom sediments (see page 4-1 of the TMDL). By modeling the nonpoint source loads in this manner, it is impossible to identify the origin of nonpoint source inputs and, thus, no entity can be held responsible for reducing nutrient inputs. If the Mississippi and Atchafalya River systems are properly identified as contributors to the nonpoint source load in subsegments 050901 and 050802, identifying targets for reduction of nutrient inputs and actual implementation of these TMDLs would be considerably easier than if the only origin for nonpoint source loading identified is a "resuspended load from bottom sediments."

Response #10: The TMDL calculations were updated after the model was revised to incorporate a new tributary input as discussed above. The results of the updated TMDL calculations are shown in Section 5 of the revised TMDL report. EPA regulations do not require that individual allocations need to be assigned to nonpoint sources. Load allocations may range from reasonably accurate estimates to gross allotments (40 C.F.R. § 130.2(g)).

Model Calibration methods in question

On page 3-2 of the TMDL, it is stated that the calibration targets for each parameter were <u>set to the average of the concentrations measured during the calibration period</u>. By using the average DO concentrations taken during the time period September 1 to October 6, 1998 for calibration purposes, the low DO values taken during this time period are, in essence, being disregarded. According to LDEQ Water Quality Standards, DO levels in subsegment 050901 cannot fall below 5.0 mg/L except as a result of natural conditions for a short amount of time. However, no natural conditions justifying these low DO values are provided. Thus, the TMDL must fully protect the subsegment against the lowest DO values measured during the identified critical period of September 1 through October 6, 1998. The average DO values for subsegment 050901 during the critical period is 3.9 mg/L, a value that masks the extremely low DO value measured on 09/23/98 of 1.9 mg/L. By calibrating the model using the average DO value of 3.9 mg/L, the use of this model for projections for critical conditions is placed in question. In order to ensure that the model is truly calibrated for critical conditions, it is necessary to use the lowest DO concentration of 1.9 mg/L measured during the identified critical period.

Response #11: The model was calibrated to averages over multiple sampling events to minimize the effects of any single field measurement that might be of questionable quality or indicative of conditions that may have lasted only a very short time. The lowest DO in this data set was measured on 9/23/98, which was about 12 days after Tropical Storm Frances dropped 8-11 inches of rain over southern Louisiana, causing storm surges of up to 5 feet along the Louisiana coast (source: http://www.nhc.noaa.gov/1998frances.html). However, to make the model more conservative, the model has been re-calibrated with the DO target set to the average of only the values on 9/01/98 and 9/23/98 (discarding the higher DO value measured on 10/06/98). The new DO calibration target is 2.9 mg/L in place of the previous 3.9 mg/L. EPA believes that the re-calibrated model is sufficiently conservative to develop TMDLs for critical conditions.

Wasteload Allocations Should be set to Zero

On page 4-2 of the TMDL, it is stated that "over and above this implicit MOS, an explicit MOS of 20% for point sources and 10% for nonpoint sources was incorporated into the TMDLs...." It is noted on 4-3 that no point source dischargers were included in the model. However, Table 5.1 includes a wasteload allocation (WLA) for Big Constance Lake. If there are no point sources, there cannot be a wasteload allocation. There are two issues of concern:

1) The TMDL states that no point sources are included, yet wasteload allocations (indicating that point sources are, in fact, included) are listed for Big Constance Lake, subsegment 050802. It is stated on page 2-4 of the TMDL that point source discharges were included in the TMDL by adding the oxygen demand to the load simulated in the model. However, because no point sources were explicitly included in the model, there should be no explicit wasteload allocation for point sources.
2) If no point sources are included (and thus the wasteload allocation is set to zero), the TMDL should not state that there is an explicit Margin of Safety (MOS) of 20% for point sources. This is misleading and suggests that additional protections for future growth and model uncertainty were included in this TMDL above and beyond the 10% explicit MOS for nonpoint sources.

Response #12: As indicated on page 5-2 of the draft report, the TMDLs for Big Constance Lake (subsegment 050802) included wasteload allocations for permit WP2513 (a sanitary wastewater discharge from a Pennzoil exploration facility in the Deep Lake field). Although this facility may discharge oxygen demanding substances, it was not included in the model due to its small magnitude (design flow =

0.0005 MGD). As shown in Table 5.1 of the draft report, the oxygen demand from this facility is negligible compared to the load for the entire subsegment. EPA believes that TMDLs should include WLAs for all oxygen demanding discharges throughout the entire subsegment (even if they are not included in the model).

Confusion of Margin of Safety and Seasonal Variation requirements

The TMDL is required to protect subsegments 050901 and 050802 all year round, including during the identified critical period of high temperatures and low flows. The purpose of the MOS is to account for the lack of knowledge concerning the relationship between load allocations and water quality. Since the TMDL must already protect these waters during the critical period, consideration of the critical period in the formulation of the TMDL should not be considered part of an implicit MOS. In section 5.5 of the TMDL, the TMDL needs to specifically identify the "conservative assumptions regarding rates and loadings" that is claimed to yield an implicit margin of safety.

Response #13: Because explicit margins of safety have been incorporated into these TMDLs, there is no requirement to include or justify an implicit margin of safety. The assumptions discussed in Sections 4.1 and 5.5 of the draft report reinforce the conservative nature of the TMDL. The fact that a conservative assumption originates with a factor associated with "seasonal" considerations need not disqualify that assumption from serving to enhance the margin of safety.

Lack of implementation plan

Nowhere in this TMDL are there assurances that a 60% load reduction and a 98% load reduction, for subsegments 050802 and 050901 respectively, will actually take place. In addition, because the man-made portions of the load reductions have not been calculated, there are no targeted man-made reductions of oxygen-demanding substances and, therefore, nothing to build an implementation plan around. How are we assured that reductions in oxygen-demanding substances will actually take place? The GRN requests EPA to fully identify its plans for implementation of this TMDL.

Response #14: See response #5 above.

COMMENTS FROM GULF RESTORATION NETWORK * MISSISSIPPI RIVER TASK FORCE DATED 11-30-01:

We submit these comments to express our concerns with the TMDL proposed for these segments.

I. These TMDL do Not Adequately Address Hypoxia in the Northern Gulf of Mexico

Big Constance Lake (subsegment 050802) and Mermentau Coastal Bays and Gulf Waters (subsegment 050901) are both listed on the state's impaired waters list for not fully supporting the designated use of propagation of fish and wildlife due to organic enrichment and low dissolved oxygen (DO) and, (subsegment 050901) excess nutrients. A portion of these segments fall within an area of seasonal hypoxia -- known as the Dead Zone -- which forms off of coastal Louisiana/Texas each year. Accordingly, establishment and successful implementation of this TMDL is paramount to addressing the ecological devastation associated with continued hypoxic conditions in the Northern Gulf of Mexico (hereinafter Gulf).

As identified by the President's Committee on Environmental and Natural Resources in their *Gulf of Mexico Hypoxia Assessment Reports* (2000) (hereinafter CENR *Assessment Reports*), the "Dead Zone" is a problem of multi-state proportions. It is a problem that involves not only the resources of the Gulf of Mexico and the people whose livelihoods depend on these resources, but also the states throughout the Mississippi and Atchafalaya River Basins whose activities directly contribute to high nitrogen loading in the Gulf. The problem remains today an issue of national concern (as illustrated by the establishment of the Mississippi River/Gulf of Mexico Nutrient Task Force) that requires a collaborative effort (comprehensively discussed in the Dead Zone Action Plan) by all of the states in the Mississippi and Atchafalaya River Basins.

Response #15: As stated in response #1, EPA acknowledges the hypoxia in the Gulf of Mexico and is currently addressing these issues. Concerning the statement that a portion of these subsegments falls within the Dead Zone, as stated in response #2 above, based on information in "Characterization of Hypoxia," EPA acknowledges that the hypoxic zone may extend close to the edge of subsegment 050901. EPA considered the data set submitted by the Gulf Restoration Network as part of its establishment of the TMDL for this subsegment. Moreover, EPA believes that this data, along with any additional data related to this subsegment or data from the hypoxia sampling program, if determined to be existing and readily available data and information, should be considered in the development of the 2002 section 303(d) list (see comment response #2).

Yet, the TMDL neither incorporate the findings of the CENR *Assessment Reports* nor did EPA attempt to involve upriver states in the preparation of the TMDL. ***We, therefore, request that: (a) the findings and data included in the CENR Assessment Reports be incorporated into the TMDL; (b) states contributing to the Dead Zone problem be directly involved in the development and implementation of this TMDL; and (c) full consideration be given to all available data, including that collected by Dr. Nancy Rabalais, Louisiana Universities Marine Consortium, as part of research funded by the National Oceanic and Atmospheric Administration and the Minerals Management Service. (Attached hereto).***

Response #16: As discussed in Response #1 EPA is currently taking action to address the hypoxia issue through the Mississippi River/Gulf of Mexico Watershed Nutrient Task Force (Task Force). The Task Force is beginning implementation of their "Action Plan for Reducing, Mitigating, and Controlling Hypoxia in the Northern Gulf of Mexico" which was submitted to Congress in January 2001.

The findings and data included in the CENR Assessment Reports, as well as data collected by Dr. Nancy Rabalais, have been incorporated into the revised TMDL report by adding descriptive text to Section 2.1, revising the downstream boundary conditions in the model, and adding a tributary to the model to represent the westward flow of water from the area of the Mississippi and Atchafalaya Rivers towards the Mermentau coastal waters (see responses #8 and #9).

II. The Model Fails to Consider DO Levels in the Lower Water Column

The models, the calibration data, and the eventual monitoring data for DO levels completed by Louisiana Department of Environmental Quality (LDEQ) are all based on surface water, within 1 meter of the surface. Although data provided in Appendix D of the TMDL shows that there are many instances in subsegments 050901 and 050802 where DO values are critically low in the water column within 1 meter of the surface (e.g., DO levels measured by LDEQ were as low as 1.9 mg/L on 09/23/98 in subsegment 050901), the TMDL does not address DO levels in the lower water column and thus fails to accurately reflect the true extent of the impairment.

Often, low DO is manifested in the lower water column, as a result of the loads that initially enter the surface waters. This is such an instance. The CENR *Assessment Reports* (see data included in these reports at the following website: http://www.nos.noaa.gov/products/pubs_hypox.html) and the attached data collected by Dr. Nancy Rabalais, Louisiana Universities Marine Consortium (see e-mail attachment entitled "SW-LA.N.Rabalais.Data.Dead.Zone.TMDL"), establish that oxygen at depth in subsegments 050901 and 050802 are critically low certain periods of each year.

However, this TMDL only addresses depleted oxygen levels and elevated nutrient levels at a 1 meter depth, with no consideration of the DO conditions in the lower water column.

As discussed previously, the Dead Zone is an ongoing and ecologically damaging threat to the rich and diverse fisheries and coastal resources found in the Northern Gulf. In order to ensure that ecosystem health and vitality are restored in the Gulf waters segment (subsegment 050901) of this TMDL, it is necessary for all modeling and data collection activities to address low oxygen conditions found in the lower water column. It is the depleted DO in the bottom waters of the Gulf, the Dead Zone, that is endangering fish and coastal resources, and the people who depend on these resources for their livelihoods, and it is this impairment that EPA must address in this TMDL.

`Response #17: See response #7 above.`

III. Inadequate Consideration of the Causes of Impairment

Research has proven that nutrient inputs into the Gulf are largely the result of freshwater influx from the Mississippi-Atchafalaya River system that flows, via the Louisiana Coastal Current (often referred to as the extended plume westward) along the Louisiana coast much of the year. The following are excerpts from CENR Assessment Reports, Topic Report 1 aptly illustrates this point:

> The Mississippi and Atchafalaya rivers are the primary riverine sources of fresh water to the Louisiana continental shelf (Dinnel and Wiseman 1986) and to the Gulf of Mexico (80% of freshwater inflow from U.S. rivers to the Gulf; Dunn 1996). The discharge of the Mississippi River system is controlled such that 30% flows seaward through the Atchafalaya River Delta and 70% through the Mississippi River Delta . . . . Approximately 53% of the Mississippi River Delta discharge flows westward onto the Louisiana shelf (U.S. Army Corps of Engineers 1974, Dinnel and Wiseman 1986), and the general flow of the Atchafalaya River effluent is to the west. (Report 1, p. 35).
>
> The less dense, fresh river discharge floats atop and mixes with the ambient coastal seawater. Initially, water enters the shelf as a buoyant plume near the river mouth. The plumes from Atchafalaya Bay and Southwest Pass of the Mississippi River Delta (and possibly other outlets of the Mississippi Delta) turn anticyclonically until they encounter the Louisiana coast (Wiseman et al. 1975). At this point they merge into a highly stratified coastal current, the Louisiana Coastal Current, often referred to as the extended plume. The coastal current flows westward along the Louisiana coast much of the year. The buoyant, low salinity waters are separated from the waters of the mid-shelf region by a strong surface-to-bottom frontal zone that typically intersects the bottom near the 10-15 m isobath. (Report 1, p. 35)

Additionally, according to the CENR *Assessment Reports*, it is excess nutrient flowing into the Gulf via the Mississippi-Atchafalaya River Basins that causes the Dead Zone. Three major changes in the Mississippi-Atchafalaya drainage basin have increased the flux in nutrient concentrations reaching the Gulf:

1) Landscape alterations such as deforestation and agricultural drainage;
2) River channelization for flood control and navigation; and
3) Major increases in fertilizer nitrogen input within the basin.
   (CENR *Integrated Assessment*, pp. 14-15).

In addition, the CENR *Assessment Report* 3 found that:

> The principal source areas for the nitrogen that discharges to the Gulf are watersheds draining intense agricultural regions in southern Minnesota, Iowa, Illinois, Indiana, and Ohio. (Report 3, p. 14).
>
> Nonpoint sources contribute about 90 % of the nitrogen and phosphorous discharging to the Gulf. Agricultural activities are the largest contributors of both nitrogen and phosphorous . . . . fertilizer plus the soil inorganic nitrogen pool [is] the largest nitrogen source, contributing 50% of the total annual nitrogen flux to the Gulf. (Report 3, p. 14).
>
> With respect to the 37 streams draining into the Gulf of Mexico (Texas - Florida), the combined flows of the Mississippi and Atchafalaya Rivers account for 80% of the total annual discharge and 91% of the estimated total nitrogen load. If only streams between Galveston Bay (Texas) and the Mississippi River Delta are considered, i.e., those most likely to influence the zone of hypoxia, the combined flows of the Mississippi and Atchafalaya Rivers account for 96% of the annual freshwater discharge and 98.5% of the total nitrogen load. (Report 3, p. 15)

These findings make clear the water quality in the nearshore Gulf waters, including the aforementioned subsegments, is controlled by the effluents of fresh water and nutrients from the Mississippi and Atchafalaya Rivers. Nevertheless, in crafting these TMDL, EPA Region VI has ignored the potential contribution of the Mississippi and Atchafalya Rivers to the impairments at issue. In particular, the model upon which the TMDL relies to identify nonpoint source allocations fails to even recognize the importance of Gulf of Mexico water flow along the Louisiana Coastal Current.

The EPA has, therefore, improperly limited the potential contribution of the Mississippi - Atchafalaya River Basins in its preparation of this TMDL. The north-south 1-dimensional model that was used to establish nonpoint source allocations for this TMDL **does not adequately address the nutrient inputs that are entering the subsegments in a westward direction**, via the Louisiana Coastal Current, and contributing to nutrient enrichment and low dissolved oxygen levels in nearshore Gulf waters, including the waters in subsegments 050901 and 050802.

The EPA must revisit this TMDL to fully incorporate the east-west contribution of nitrogen by the Mississippi-Atchafalaya River Basins, and replace the 1-dimensional model used to establish point source allocations with a 2-dimensional model that properly accounts for both the east-west and north-south nutrient inputs associated with these water segments.

Response #18: The excerpts above from the CENR Assessment Reports document that the Mississippi and Atchafalaya Rivers contribute a large portion of the nutrient load that is responsible for hypoxia in the Gulf of Mexico. EPA believes that water quality in subsegment 050901 may be affected (but not controlled) by nutrients from coastal currents from the Mississippi and Atchafalaya Rivers. To incorporate influence of the Louisiana Coastal Current on these subsegments, the model has been revised to include a tributary inflow from the east. (See Response #8).

IV. All Nonpoint Source Loads Need to Be Identified to Ensure Implementation

Because the model used in the development of this TMDL was based on a north-south 1-dimensional flow: (1) only headwaters and tributaries north of the Big Constance Lake and Mermentau coastal bays and Gulf waters were considered as nonpoint source contributors; (2) no nutrient inputs from headwaters or tributaries were considered in this model because the flow rates of all headwaters and tributaries were set equal to zero; and (3) no explicit origin of nutrient loads was included in the TMDL. As a result, nonpoint source loads are modeled as a **resuspended** load from the bottom sediments (See page 4-1 of the TMDL).

By modeling the nonpoint source loads in this manner, the EPA has made it impossible to identify the origin of nonpoint source inputs and, thus, no entity can be held responsible for reducing nutrient inputs. If, on the other hand, the Mississippi and Atchafalya River Basins are properly identified as contributors to the nonpoint source load in subsegments 050901 and 050802, identifying targets for reduction of nutrient inputs and actual implementation of this TMDL would be possible. For example, the CENR *Assessment Reports* and CENR *Integrated Assessment* provide much of the data needed by EPA to identify the sources of impairment flowing from the Mississippi-Atchafalya River Basins. Accordingly, the EPA must revisit this TMDL to identify contributors to the nonpoint source load in each of these subsegments.

Response #19: As mentioned above, influence from the Louisiana Coastal Current has been incorporated by revising the model to include a tributary inflow from the east as described in response #8. The TMDL calculations were subsequently revised to include the loads from this inflow (see response #10).

V. Confusion of Margin of Safety and Seasonal Variation requirements

The TMDL is required to protect subsegments 050901 and 050802 all year round, including during the identified critical period of high temperatures and low flows. The purpose of the Margin of Safety (MOS) is to account for the lack of knowledge concerning the relationship between load allocations and water quality. Since the TMDL must already protect these waters during the critical period, consideration of the critical period in the formulation of the TMDL should not be considered part of an implicit MOS. In addition, in section 5.5 of the TMDL, the TMDL needs to specifically identify the "conservative assumptions regarding rates and loadings" that is claimed to yield an implicit margin of safety.

Response #20: See response #13 above.

VI. Lack of implementation plan

Nowhere in this TMDL are there assurances that a 60% load reduction and a 98% load reduction, for subsegments 050802 and 050901 respectively, will actually take place. In addition, because the man-made portions of the load reductions have not been calculated, there are no targeted man-made reductions of oxygen-demanding substances and, therefore, nothing to build an implementation plan around. The data necessary to calculate the man-made portion of the nonpoint source load is available to the EPA in the CENR *Assessment Reports* and the CENR *Integrated Assessment* (both documents are available at http://www.nos.noaa.gov/products/pubs_hypox.html). In the final TMDL, EPA must provide reasonable assurances that reductions in oxygen-demanding substances will actually take place in subsegments 050901 and 050802. These reasonable assurances should take the form of a plan for implementation, which includes a timeline for implementation, relevant water quality benchmarks, and milestones for the successful implementation of the plan.

Response #21: See response #5 above. In addition, EPA's current regulations do not require reasonable assurances that the TMDL will be implemented.

We urge EPA to revisit this TMDL to address each of the above stated concerns.

COMMENTS FROM DR. NANCY RABALAIS DATED 11-30-01:

I would like to register my scientific opinion concerning the TMDLs proposed for the above referenced area of the Louisiana coast. My ability to do so comes from 15+ years of experience in examining dissolved oxygen, nutrients, hypoxia and eutrophication in estuaries and coastal waters. These views do not represent my employing institution.

I initially examined the TMDL document at the request of several NGO groups, and subsequently provided them with my thoughts on the condition of the nearshore waters of the Gulf of Mexico off the southwestern Louisiana shelf and with the existing data from our datasets that were pertinent to that area. It is a bit distressing to me that the individuals preparing the TMDL did not access the publicly available data, in the NOAA NODC and the NOAA NECOP web sites, for information on the area before the TMDL draft was completed. These data have been acquired over the years of my hypoxia research since 1985 as funded primarily by NOAA and MMS and are a valuable resource for making decisions concerning water quality in the State of Louisiana. The appropriate web sites for future reference are:

http://www.nodc.noaa.gov/ and http://www.aoml.noaa.gov/ocd/necop/.

There are also numerous reports and assessments of the nearshore coastal zone as a result of the years of NOAA and MMS research in the area.

Response #22: The data and information noted in these comments have been incorporated in the revised modeling and TMDL report as discussed in response #16 above. Moreover, EPA believes that this data, along with any additional data related to this subsegment or data from the hypoxia sampling program, if determined to be existing and readily available data and information, should be considered in the development of the 2002 section 303(d) list. (see comment response #2).

Having reviewed the draft TMDL document and the data, I would like to make a few comments from the viewpoint of a research scientist:

(1) The source of water and nutrients that most directly and importantly affects the area of concern is from the Louisiana Coastal Current that entrains the discharge and nutrient load of the Atchafalaya River and even the Mississippi River. Given the low discharge from within the study area (reduced to zero in the model that supports the TMDL), the offshore waters are the primary influence on the area. They affect the offshore segment and they probably interact with the estuary through advective tidal flux (similar to areas on the southeastern Louisiana coast). It is well known and documented that the interactions of physics and biology, which are mostly influenced by the freshwater discharge of the Mississippi and Atchafalaya Rivers and the nutrients that stimulate primary productivity leading to

low dissolved oxygen in the lower water column, are the prime factors in the development and maintenance of hypoxia during a seasonal cycle and the cause of its increase and worsening over the last half century. It seems critical that these inputs to the area of concern be considered.

Response #23: To incorporate any influence of the Louisiana Coastal Current to the area of concern, the model has been revised to include a tributary inflow from the east as described above in response #8.

(2) While most of the dissolved oxygen values for the area of concern in the 3-mile state territorial offshore area in the upper water column (within 1 m of the surface) are 5 mg/l or above, there are many instances of bottom-water oxygen values below 5 mg/l and often hypoxic, below 2 mg/l, in the data set. These are mostly in the summer during which time the hypoxia is most widespread, persistent and severe. This level of oxygen would preclude demersal fish and shellfish, and the area would not meet the needs of either recreational or commercial fishers trying to catch by line or trawl such sea life as redfish or shrimp.

Response #24: See response #7 above.

These two points and the available data and literature should be taken into account in the development of a TMDL document and eventual resolution of the proposed load reductions proposed.

GENERAL COMMENTS FROM LOUISIANA DEPARTMENT OF ENVIRONMENTAL QUALITY (LDEQ) (some of these comments may not apply to this report):

In view of LDEQ's TMDL development schedule and the rapidly approaching deadline, LDEQ has made a limited review of the TMDLs published by EPA on October 15, 2001. LDEQ expects to make a more detailed review on at least some of these TMDLs after the first of the year. In the future, LDEQ requests that EPA provide hard copies of the TMDLs and Appendices for LDEQ review. Several electronic files required software which is not used by LDEQ thus making it impossible to review some portions of several TMDLs. Hard copies will insure that the complete official document is being reviewed and will eliminate the time required for LDEQ to try to put together the document from electronic files. In general, LDEQ found these TMDLs to be unacceptable, based on inadequate data and not implementable.

Federal Register Notice: Volume 66, Number 199, pages 52403 - 52404 (10/15/2001)

A. Vermilion River Cutoff DO and Nutrients .pdf
B. Bayou Chene DO .pdf
C. Bayou du Portage DO .pdf
D. Bayou Mallet DO, Nutrients and Ammonia .pdf
E. Bayou Petite Anse DO and Nutrients .pdf
F. Bayou Tigre DO and Nutrients .pdf
G. Big Constance Lake and Mermentau Coastal Bays and Gulf Water TMDLs for DO and Nutrients .pdf
H. Charenton Drainage and Navigation Canal and West Cote Blanche Bay TMDLs for DO and Nutrients.pdf
I. Chatlin Lake Canal/Bayou Du Lac and Bayou Des Glaises Diversion Channel TMDLs for DO and Nutrients.pdf
J. Dugas Canal DO and Nutrients .pdf
K. Franklin Canal DO and Nutrients .pdf
L. Freshwater Bayou Canal DO and Nutrients .pdf
M. Irish Ditch/Big Bayou DO .pdf
N. Lake Arthur, Grand Lake, and Gulf Intracoastal Waterway TMDLs for DO, Nutrients, and Ammonia .pdf
O. Lake Peigneur DO and Nutrients .pdf
P. New Iberia Southern Drainage Canal DO and Nutrients .pdf
Q. Spanish Lake DO .pdf
R. Tete Bayou DO and Nutrients .pdf
S. Bayou Carron DO and Nutrients .pdf
T. West Atchafalaya Basin Protection Levee Borrow Pit Canal DO.pdf

1. Many of these TMDLs are based on models using historical water quality data gathered at a single location rather than survey data gathered at several sites spaced throughout the

waterbody. Hydraulic information used was generally not taken at the same time as the water quality data used. The availability of only one water quality data site is not sufficient justification to simulate the subsegment using a one reach, one element model. Additional reaches and elements must be used to represent the subsegment and additional data must be obtained in order for these TMDLs to be valid. The recommended maximum limits cited in the LAQUAL User's Manual for element width and length have been grossly exceeded in many of the models. The spreadsheet calibration and projection graphs that were provided do not match the plots produced by the LA-QUAL model. Please explain why they do not match. The LAQUAL graphics for a few elements produces a graph that does not represent the model output. It's an anomaly of the graphics routine. The calibrations are inadequate due to the lack of a hydrologic calibration and the paucity of water quality data. The resulting TMDLs are invalid. LDEQ does not accept these TMDLs.

Response: The TMDLs were based on existing data plus information that could be obtained with available resources. Each model was developed using the most appropriate hydraulic information and water quality data that were available. The level of detail at which each subsegment was modeled was consistent with the amount of available data. Although having only one element in a model causes inaccuracies in the LAQUAL graphics, having only one element in a model does NOT cause errors in the tabular output (which is what the graphs in the reports are based on). Although LDEQ typically collects more data for model calibration than what was available for calibration of these models, EPA considers these model calibrations and the resulting TMDLs to be valid.

2. LDEQ does not consider any of these waters to be impaired due to nutrients or ammonia. LDEQ does not consider Vermilion River Cutoff (060803), Mermentau Coastal Bays and Gulf Water (050901), Charenton Drainage and Navigation Canal (060601), West Cote Blanche Bay (061001), Bayou Des Glaises Diversion channel (060207), Grand Lake (070701), Gulf Intracoastal Waterway (050702, Lake Peigneur (060909), New Iberia Southern Drainage Canal (060904) and West Atchafalaya Basin Protection Levee Borrow Pit Canal to be impaired by biochemical oxygen-demanding substances. Many of these waters simply have inappropriate standards and criteria. The resources spent on developing these TMDLs could have been far more effectively and wisely spent on reviewing, approving, and assisting in the development of appropriate standards and criteria for these waters through the UAA process.

Response: TMDLs were developed for these subsegments based on the requirements of Section 303(d) of the Clean Water Act and regulations at 40 CFR 130.7 and the suspected causes of impairment (organic enrichment/low DO, nutrients, or ammonia) for each subsegment in the EPA Modified Court Ordered 303(d) List.

3. Remove the reference and all references to the unpublished LDEQ document, "Defaults for Uncalibrated Modeling". This is not an acceptable reference and any defaults selected on this basis must be reevaluated and based on acceptable references. Some of the models must be

redone because of inappropriately selected defaults. At this time, LDEQ has no plans to revise, complete or publish this document.

Response: The unpublished LDEQ document that is mentioned here was provided to EPA's contractor without any instructions not to use it. The model coefficients listed in that document appear to be reasonable and consistent with values used in other modeling studies in southern Louisiana.

4. The percent reduction of the nonpoint source load must not be reported as an overall average of the individual percent reduction applied to each reach. This approach does not insure that standards will be met in all reaches and will be difficult to implement. In consideration of future implementation plans, LDEQ does not vary the percent reduction required from reach to reach. LDEQ uses a uniform percent reduction within a watershed unless there are unique conditions, such as a general change in landuse, that dictate a further breakdown. These unique conditions must be adequately documented in the report in order to facilitate future implementation plans. Specifying type of land use is helpful in defining nonpoint loading. LDEQ requests a calculation sheet of the NPS reduction percentages and asks that language be added to the report describing the calculation process.

Response: EPA appreciates this comment but believes that an average percent reduction is acceptable. EPA will consider this in future development of TMDLs in Louisiana.

In the lower Mermentau and Vermilion River Basins, much of the nonpoint loading affecting some of these subsegments and adding to their benthic blanket is coming from the tributaries feeding them. Many of the headwater tributaries have recent TMDL's that require dramatic percentage reductions to the nonpoint contributions. By implementing the reductions to nonpoint loads upstream, the current problems in these lower subsegments will be reduced.

Response: EPA recognizes that TMDLs have been developed upstream of several of these subsegments. Implementing upstream reductions in nonpoint loads should require much less reduction of loadings from within these subsegments. The required percent reductions for these subsegments were not intended to be in addition to upstream reductions.

5. The percentage reductions listed were not calculated based on the written procedure described in several TMDLs. These values did not take the MOS into consideration. It is also LDEQ's policy to make a no-man-made load projection run which will estimate the natural background loads. The contractor should include a no-man-made load projection run in each TMDL report.

Response: The percent reductions were calculated by subtracting the projection input value from the calibration input value and then dividing by the calibration input value. This procedure is slightly different than what LDEQ uses but still provides percent reductions that are useful.

6. CBODu and NH3-N were estimated from surrogate parameters rather than actual measured data for most of the TMDLs. Based on the measured data from the last two years of LDEQ water quality surveys, LDEQ objects to the correlation of TOC to CBOD and NH3-N to TKN, unless these correlations are taken from water quality data on the modeled waterbody. Our studies have shown only a moderate correlation between these two parameters within the same waterbody, however when this correlation was attempted across waterbodies extreme variability was seen and the correlation was not judged valid. It is possible that a combination of surrogates will obtain a better correlation, such as TOC along with color, turbidity, pH, etc. LDEQ is currently researching these options.

Response: EPA agrees that it would be ideal to have data collected from the modeled waterbody for relating TOC to CBOD and NH3-N to TKN. However, for these subsegments, there was insufficient data from which these relationships could be developed.

7. LDEQ takes exception to the equating of COD to CBODu in some of the TMDLs. There is no data to support this assumption. No direct correlation has been drawn between these two parameters. The only correlations that have been found are variable and dependant on the type of discharge. LDEQ requests that facilities with only COD limits be removed from the WLA load calculations.

Response: EPA agrees that COD is not an ideal indicator of CBODu. However, EPA believes that most effluents that exert significant COD are likely to exert some oxygen demand in natural waterbodies and therefore the discharges with COD limits should be included in the TMDLs.

8. CBODU and Org-N settling rates were not used. This is not justifiable in areas dominated by agricultural activities and is poor practice for TMDLs on Louisiana waters. The models must be revised to include settling rates.

Response: Without the use of settling rates, all of the pollutant loading remains in the water column where it can consume oxygen. Depending on the model settings for conversion of settled pollutant loading to SOD, the model can be more conservative without settling rates. Other applications of water quality models for TMDLs on southern Louisiana waterbodies have not used settling rates and have been approved by LDEQ.

9. The TMDLs should be for biochemical oxygen-demanding substances instead of DO. DO is an indicator of the impact of biochemical oxygen demanding load, hydrologic modifications, excessive algae blooms, etc.

Response: The TMDLs in Section 5 of each report are already expressed in terms of oxygen demand.

10. Nitrification inhibition option number 2 is valid for Louisiana's waterbodies. Various studies have shown that Louisiana does not have a buildup of NH3-N in its waterbodies. If option 1 was needed for a proper calibration then that should be stated as such.

Response: The nitrification inhibition option was set based on algorithms in other widely used water quality models. Option 1 has been used in other water quality modeling applications for TMDLs on southern Louisiana waterbodies that have been approved by LDEQ.

11. A winter projection model was not developed for most of the TMDLs. Winter projection models must be developed to address seasonality requirements of the Clean Water Act. Where point sources have seasonally variable effluent limitations or such seasonal variations are proposed, a winter projection model is required to show that standards are met year-round.

Response: As discussed in Section 4.2 of each report, summer is the most critical season for meeting the year round standard for DO for this subsegment. Therefore, the summer simulation satisfies the seasonality requirements of the Clean Water Act. Performing additional simulations to evaluate permit limits that are seasonal or hydrograph controlled releases was not required for developing these TMDLs and can be done by LDEQ or by permittees.

12. There was no documentation (LA-QUAL plots) to indicate that the model was calibrated to all hydrologic parameters (i.e. flow, width, depth, time of travel, velocity, chloride balance, etc.). Apparently flow balances were performed, however a flow balance is not a hydrologic calibration. Most of the models must be recalibrated with adequate hydrologic data. Calibration plots for all of the hydrologic parameters must be provided in the appendices.

Response: The values of depth, width, and flow in each model were estimated based upon the most appropriate available information. Hydraulic calibration of each model was not possible due to a lack of data.

13. The calibration and projection plots for dissolved oxygen must be provided in the body of the reports. Additional projection plots for CBODU, NH3-N, and Org-N must be provided in the appendices.

Response: The placement and number of plots in the draft reports are acceptable.

14. The calibration simulation must be used as the baseline for the sensitivity analysis, not the projection simulation. LDEQ requests that all TMDLs be revised in this regard.

Response: The sensitivity analysis can be developed using either the calibration or the projection as a baseline. EPA will consider this in future development of TMDLs in Louisiana.

15. A list of all point source dischargers must be provided in the body of the reports. Only dischargers with flows that reach the named waterbody should be included in the TMDLs.

In several TMDLs, a default 0.001 MGD flow rate was assigned to dischargers where a flow rate was not available. This practice is unacceptable to LDEQ. This default flow rate is extremely low (LDEQ would typically use 0.005 MGD as a minimum) and could strictly limit these dischargers' allowable permit loads when their permits are renewed. Additional research should be done to determine the facility type and anticipated flow rates of these facilities.

Response: The placement of the list of point source dischargers in the draft reports is acceptable. The dischargers with no flow rate information are believed to have very small flow rates representing a very small portion of the total TMDLs. The actual flow rate for each facility can be determined by LDEQ when the facility's permit is being renewed.

16. LDEQ does not agree with the minor point sources loads being subtracted from the NPS load as was done in several of the TMDLs. The pollutant loads being addressed are non-conservative loads. Many of these dischargers are located on small tributaries to the 303(d) waterbody which have recovered prior to entering into that system. Thus they are not contributing to the pollutant loads in the impaired waterbody. LDEQ's current procedure is to add these loads to the WLA portion of the TMDL.

Response: In the reports for which this comment is applicable, the TMDL calculations have been revised so that these loads are added to the WLA portion of the TMDL (same as LDEQ's procedure). For most of the draft reports, the TMDL calculations already used LDEQ's procedure of adding the minor point sources to the modeled loads.

17. Proper justification must be provided when using a nonpoint source margin of safety value other than the typical LDEQ value of 20%.

Response: The nonpoint margin of safety (MOS) was set to 10% based on other TMDLS on southern Louisiana waterbodies that have either been developed by LDEQ or approved by LDEQ. Eleven TMDL reports from LDEQ's website were reviewed to examine the explicit MOS for nonpoint sources. All 11 of these TMDLs were for oxygen demanding substances in the Mermentau or Vermilion-Teche basins. The explicit MOS for nonpoint sources was set to 20% for 2 reports, 10% for 3 reports, and 0% for 6 reports. Therefore, the value of 10% was considered to be a typical value that did not need special justification.

18. LDEQ has major concerns relating to the use of a one dimensional steady state model in coastal bays, lakes and estuaries. These systems are typically dominated by tides and winds and do not behave like riverine systems. LAQUAL can be used to simulate estuarine systems with riverine characteristics and some tidal influences; however to use it in these applications exceeds the model's recommended input limitations and appears to produce a meaningless output. Also the

systems' unique hydrological characteristics do not adapt well to LAQUAL's one-dimensional capabilities. A multi-dimensional model such as WASP should be used for these waters. While a dynamic model would be preferred, a steady-state multi-dimensional model would be acceptable if it adequately addresses tidal influences. LDEQ objects to the use of LAQUAL in determining TMDLs for coastal bays, lakes and estuaries.

Response: A one dimensional steady state model such as LAQUAL was considered to be appropriate for all of these subsegments based on the amount of data that were available. Proper application of a multi-dimensional model or a dynamic model would require much more data and is simply not necessary for these waterbodies. For large, wide waterbodies, WASP will yield the same results as LAQUAL if the configuration of elements and model coefficients are the same between the two models.

19. The report uses the term synoptic survey multiple times. Please describe in detail what area this survey encompassed as well as site locations and what parameters were tested. Also, the raw data from this survey must be included in the appendices as support for the model inputs and calculations.

Response: A description of the synoptic survey and a summary of the data have been added to the appendices for each report in which those data are used.

20. In many of the calibration models the average water quality data from several LDEQ stations were used. It has been LDEQ's experience that a better calibration can be accomplished by using a single day's water quality and flow data. The additional daily values could then be used to perform multiple verifications of the model parameters before proceeding to the projection stage. The flow data should be collected at the same time as the water quality data in order for the model to be valid.

Response: The models were calibrated to averages over multiple sampling events to minimize the effects of any single field measurement that might be of questionable quality or indicative of conditions that may have lasted only a very short time. For large systems with long residence times, using only a single snapshot of water quality data is often not representative of steady state conditions for that system.

21. Grammatical errors and misspelled words were found in these reports.

Response: The reports have been reviewed for grammar and spelling.

22. There does not appear to be any significant anthropogenic source of nutrients from agriculture, silviculture, aquaculture or urban runoff in many of these subsegments. Therefore, any occurrence of low DO is almost certainly natural. As a result, a UAA for the area is necessary

to reset the DO standard. A TMDL is unwarranted for these subsegments,and LDEQ takes exception to EPA generating TMDLs which are impossible to implement.

Response: EPA is required to generate these TMDLs based on the Modified Court Ordered 303(d) List and the requirements of Section 303(d) of the Clean Water Act and regulations at 40 CFR 130.7.

23. LDEQ's nutrient standard is based on total phosphorus (TP) and total nitrogen (TN), not total inorganic nitrogen (TIN). Since phosphorus is not the limiting constituent in Louisiana, the nutrient allocations must be in terms of TN and only TN.

Response: LDEQ's nutrient standard (LAC 33:IX.1113.B.8) does not specify that nitrogen to phosphorus ratios should be based on total nitrogen. However, EPA will consider this in future development of TMDLs in Louisiana.

In the coastal areas, the nitrogen to phosphorus ratio used was based on freshwater streams and is not applicable to brackish Gulf waters. LDEQ takes exception to the calculation of a TMDL based on TN/TP ratios derived from waterbodies other than the modeled waterbody. It is LDEQ's experience that the natural allowable TN/TP ratio is waterbody-specific and can vary dramatically between streams.

Response: EPA agrees that it would be ideal to have a large database of nitrogen to phosphorus ratios for each waterbody. However, because these subsegments have only limited nutrient data, the previously developed nitrogen to phosphorus ratio that was used in the draft reports is considered acceptable.

LDEQ has not adopted the EPA recommended ammonia criteria (1999) and takes exception to its use in this TMDL. In general, LDEQ does not accept EPA's use of national guidance for TMDL endpoints. The nationally recommended criteria do not consider regional or site-specific conditions or species and may be inappropriately over protective or under protective. No ammonia nitrogen toxicity has been demonstrated or documented in any of the waterbodies in these TMDLs. The general criteria (in particular, LAC 33:IX.1113.B.5) require state waters be free from the effects of toxic substances.

Response: Ammonia TMDLs were developed for two subsegments based on the requirements of Section 303(d) of the Clean Water Act and regulations at 40 CFR 130.7 and the fact that the Modified Court Ordered 303(d) List included ammonia as a suspected cause of impairment for those two subsegments. National guidance for ammonia toxicity was used in the absence of any numerical state water quality standards for ammonia.

24. The implicit margin-of-safety must not be quantified.

Response: The text of the reports has been revised to eliminate any quantification of the implicit margin of safety.

25. EXECUTIVE SUMMARIES: Add summary tables of the WLAs, LAs, and TMDLs showing the allocations and margins of safety.

Response: The summary tables of the WLAs, LAs, and TMDLs can be easily found in Section 5 of each report and do not need to be repeated in the executive summary.

26. Temperature Correction of Kinetics: A temperature correction factor was set for reaeration. It is LDEQ's standard practice to allow LAQUAL to calculate this factor. There is more guidance on this in the LAQUAL User's Manual.

Response: The temperature correction factor was reaeration was set to the value of 1.024 based on guidance in Section 3.3.8 of the LTP.

27. Water Quality Kinetics: The Louisiana reaeration equation was used on reaches that are outside the maximum depth that it was designed for. A more appropriate reaeration equation must be selected.

Response: The Louisiana equation yielded reaeration coefficients that appeared more reasonable than coefficients from other equations.

28. Water Quality standards and designated uses tables did not include the BAC (bacterial criteria) values.

Response: The water quality standards for bacteria are not relevant for these TMDLs.

29. The statement was made in the Initial Conditions paragraphs in several of the reports that temperature was specified because the temperature was not being simulated. The section then states, "For constituents not being simulated, the initial concentrations were set to zero …". Initial conditions provide a starting point for the iterative solution of modeled constituents. They also provide values for constituents that are needed as input but are not being simulated.

Response: EPA appreciates this comment.

30. Several reports describe the benthic ammonia source rate as a calibration parameter; however a review of the data type 13 calibration input section indicates a value of zero for this parameter, in all reaches.

Response: The benthic ammonia source rate was used as a calibration parameter; the value of that parameter that provided the best fit between predicted and observed values was zero.

31. Calibration, and Projection, Data type 27: A salinity value was set to zero in the boundary conditions for both the calibration and the projection models in several of the TMDLs. With this value set to zero the model will automatically adjust the values of the lowest reach's elements to the value set in the boundary conditions. Since most of the models were one-reach,

one-element models, the model automatically set the element salinity to zero, thus calculating an inaccurate value for the DO saturation.

Response: The only models where salinity was set to zero in the downstream boundary conditions were those models where salinity was not considered high enough to have a significant impact on DO saturation.

32. It is not LDEQ's standard procedure to use a zero headwater flow. You may not have input a headwater flow, but the model did. Without a headwater flow the model would have crashed and not run. The model's programming allows for a 0.0000001 cms flow rate when the modeler has not input a headwater flow.

Response: Only two simulations (calibrations for Spanish Lake and Big Constance Lake) used a zero headwater flow. For all practical purposes, 0.0000001 m3/sec is the same as zero flow.

33. Hydraulics and Dispersion: The use of constant widths and depths requires proper justification.

Response: The widths and depths were justified in Section 3 of each report.

34. Several reports state that algae were not simulated because algae did not appear to have significant impacts. What was the evidence for this statement? Did the contractor have any Chlorophyll a measurements?

Response: This statement was based on general knowledge of the Mermentau and Vermilion-Teche basins as well as a limited amount of diurnal DO data collected in these basins.

SPECIFIC COMMENTS FROM LDEQ FOR BIG CONSTANCE LAKE AND MERMENTAU COASTAL BAYS AND GULF WATERS:

1. 3.4 Hydraulics and Dispersion, page 3-3, paragraph 1: How were the depth values estimated from the data sets given? The reviewer was unable to verify the given model inputs.

Response: Depth for the Big Constance Lake subsegment was estimated based on verbal information from Rockefeller Wildlife Refuge staff. Depth for the Mermentau Gulf Waters subsegment was based on bathymetric contours from USGS 1:100,000 scale topographic maps.

2. According to the input justifications the width in subsegment 050802 was based on a 33% water surface coverage in total surface area. What data was this percent based on?

Response: The 33% water surface coverage was based on the 1998 GAP land use data (shown in Table 2.1).

3. Upon a review of the Department's GIS datasets, LDEQ questions the width and length values listed in the calibration and projection model inputs. In some cases the value given is 50% higher than the measured value. LDEQ suggests that the contractor verify these values based on more accurate GIS datasets.

Response: The widths for both subsegments have been corrected and the lengths for the Big Constance subsegment has been corrected.

4. 3.6 Water Quality Kinetics, page 3-4, paragraph 1: The Reaeration rates used were based on the Mini KL equation of 0.7 m/day, then adjusted for wind. This equation was used due to the low stream velocities. However a tidal height was not used in the calibration model. If the tidal conditions had been simulated, the average velocity would have been dramatically higher than the advective velocity. With an increased velocity other reaeration equations may be more appropriate. LDEQ concurs with the use of a wind adjustment to the reaeration rate, but suggests a review concerning a more appropriate base reaeration equation.

Response: It is doubtful that the tidal velocity would be large enough to justify using another equation such as O'Connor-Dobbins. Even if the tidal velocity was high, using the wind-based reaeration would be more conservative.

5 <u>3.11 Lower Boundary Condition, page 3-6, paragraph 1</u>: The site that was chosen by the contractor for the lower boundary condition is not representative of the true boundary condition, which is located in the Gulf of Mexico. A more appropriate boundary site would be LDEQ ambient site 0852.

Response: LDEQ site 0852 (in the Calcasieu Coastal Waters subsegment) was not an acceptable site because it has been sampled on only five occasions, all of which were in a different year than the calibration period for this model and none of which were in the months of September or October.

6. <u>4.2 Temperature Inputs, page 4-2, paragraph 2</u>: The choice of ambient site to determine a 90th percentile temperature is inappropriate. The site chosen was a freshwater advective flowing stream. This site's temperature data was adjusted to correlate to the measured data in the modeled subsegments. These two sites represent dramatically different waterbodies, making the correlation between them an unacceptable practice.

Response: There are no LDEQ coastal stations with long term temperature data for this analysis. The site chosen is considered acceptable because of its proximity. The difference between freshwater and seawater is not relevant for temperature.

7. <u>4.5 Nonpoint Source Loads, page 4-3, paragraph 1</u>: Paragraph states that the benthic ammonia source rates were reduced. This is incorrect. The benthic ammonia source rate was not included as a calibration parameter.

Response: The benthic ammonia loads were not excluded from reductions for the projection; rather, they were already set to zero in the calibration. However, for clarity, the words "benthic ammonia source rates" have been deleted from the sentence in Section 4.5.

8. 4.9 Model Results for Projection, page 4-4, paragraph 2: The NPS load reductions in these areas is unreasonable and unfeasible. Subsegment 050802 is a wildlife management area, and 050901 consists of the inland Gulf of Mexico. Neither of these subsegments generates the nonpoint loading that is affecting them. Any reductions in these waters would have a minimal affect on the dissolved oxygen concentrations.

Response: Specifying a reduction in nonpoint loading is not intended to imply that all reductions should come from within that subsegment.

9. 5.4 Seasonal Variations, page 5-4, paragraph 1: The report states "In addition, the models account for loadings that occur at higher flows by modeling SOD". Several other parameters should also be added to SOD, including resuspended CBOD and Organic Nitrogen.

Response: The text has been revised to include resuspended CBOD and organic nitrogen.

GENERAL COMMENTS FROM LOUISIANA STATE UNIVERSITY (LSU) AG CENTER
(some of these comments may not apply to this report):

Through this letter the Louisiana State University AgCenter would like to submit official comments on TMDLs for dissolved oxygen and nutrients associated allocations for waterbodies in:

- Vermilion River Cutoff
- Bayou Chene
- Bayou Petite Anse
- Bayou Tigre
- Big Constance Lake and Mermentau Coastal Bays and Gulf Water
- Charenton Drainage and Navigation Canal and West Cote Blanche Bay
- Chatlin Lake Canal/Bayou Du Lac and Bayou Des Glaises Diversion Channel
- Dugas Canal
- Franklin Canal
- Freshwater Bayou Canal
- Irish Ditch/Big Bayou

- Lake Arthur, Grand Lake, and Gulf Intracoastal Waterway
- Lake Peigneur
- New Iberia Southern Drainage Canal
- Spanish Lake
- Tete Bayou
- Bayou Carron
- West Atchafalaya Basin Protection Levee Borrow Pit Canal

The number of different TMDLs sent out for comment at the same time may overwhelm the public's ability to comment. With only 30 days to prepare and submit comments it is impossible for a qualified faculty member to review the supporting data in depth and attend to his(her) official responsibilities. I realize that the agency is under time constraints on completing these, but I earnestly request that more time per proposed TMDL be given in the future.

We must make several other general comments and objections that apply to most of the proposed TMDLs. In many cases the data used to calibrate the models for the stream segments was collected in the fall of 2000 near the end of a three year drought. Historic low flows were often commented on in the text of the TMDL. Low flows result in a biased estimate of the natural ability of the stream to reaerate and cleanse itself of pollutants. Low flows also enable the benthic blanket to accumulate and remain in place undisturbed causing overstatement of the benthic oxygen demand and the SOD which were in many cases the primary oxygen demand loads in the stream. While it is true that the high flows that come from storm events carry more organic and sediment loads into the stream, the high flow rates also scour material from the bottoms and move it on to a final deposit at the stream terminus. It was thus that most of Louisiana and all of our coastal areas were built. Prolonged drought conditions do not allow this natural cleansing to occur. Thus it is our belief that the part of the oxygen demand load attributed to benthic and sediments is overstated and that new data must be collected during normal rainfall conditions and the models re-calibrated.

Response: The Louisiana water quality standards are applicable during all flow conditions greater than the 7Q10. Because 7Q10 flow is frequently the most critical condition for maintaining the DO standard, it is desirable to collect field data for model calibration during times when the hydrology is as close as possible to 7Q10 conditions. It is believed that the flow conditions for these waterbodies may have been near 7Q10 conditions, but probably not lower than 7Q10 flows. Therefore, the summer-fall 1998 data is desirable for model calibration.

In far too many of the proposed TMDLs the phrase *"an intensive field survey was not conducted for the study area due to schedule and budget limitations"* was found. If municipalities, agriculture, and business entities are to be asked to make large commitments of funds, time and effort to resolve our water quality problems they deserve to have the benefit of a serious study of the problem. We request that all of the proposed TMDLs that contain this statement have this problem corrected and that TMDLs be prepared based on complete studies.

Response: There is no requirement for collecting a certain amount of data to make a TMDL valid. If additional data are collected in the future by LDEQ, other agencies, or local stakeholders, then those data can be evaluated at the time and the implementation of the TMDL can be altered as necessary. As outlined in the 1991 EPA document titled "Guidance for Water Quality-Based

Decisions: The TMDL Process", developing and implementing TMDLs is a process and not a one-time event.

In several of the proposed TMDLs data was used that is 9 or 10 years old from studies on point source discharges. While the data is probably high quality it assumes that no change in the plant or its load have occurred in the last decade. This assumption may not be defensible. In the TMDLs where a treatment plant was included in the model the margin of error was calculated by using 125% of the design capacity. This assumes a plant will perform at the same level when it is operated in excess of its design load. This assumption is also questionable.

Response: For several subsegments, old data sets were used for calibration because they provided more extensive data than newer data sets. However, all of the projection runs simulated point source discharges based on the most recent information available. Simulating point source discharges at 125% of design flow is simply a way of incorporating an explicit margin of safety and does not assume that the facility can actually treat that much wastewater.

The standard for dissolved oxygen (DO) was held at 5 mg/L in some steams on a year round basis, even if it received or discharged into a stream with 5 mg/L winter and 2 or 3 mg/l summer standards. Other streams had a year DO oxygen standard of 4 mg/L. We strongly suggest that a review be made of the DO standards for all of the streams in south Louisiana that are shallow, sluggish, and subject to tidal influence and that uniform standards be set. In view of the remarks that achieving a DO of 5 mg/L was impossible in some of the streams that had little loading from human activities, we believe that the summer standard of 2 mg/L is much more applicable to these streams.

Response: The TMDLs are required to be developed for the existing DO standard, which is 5 mg/L year round for many of these subsegments. If the DO standard is revised in the future for any of these subsegments, the TMDL and implementation can be altered as necessary as part of the TMDL process.

Many of these TMDLs were drafted by an out of state contractor and do not appear to be as well researched as those drafted by LDEQ. Very little data was included in the contractor drafted TMDLs summaries as compared to the ones prepared by or in conjunction with LDEQ. Additionally, the bulk of the text appeared to be standard wording in all documents with short relevant inserts. We would request that if outside contractors be used in future TMDL assessments that they be held to the same standard of information inclusion that LDEQ provides. Stream diagrams and maps are often needed when reviewing descriptive text on stream location, tributary insert, and exact location.

Response: These TMDLs contain all the required components of a TMDL and the level of detail is considered acceptable. Because these TMDLs could not be funded at the same level as most of LDEQ's DO TMDLs, the analysis and documentation was not as extensive as most of LDEQ's DO TMDLs. However, some of the information that was mentioned in the comment (stream diagrams and maps) was included in the reports, but they were placed in the appendices (which were available from EPA upon request).